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Model Engineer

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ONE SHILLING 17 JANUARY 1957 VOL 116 NO 2904

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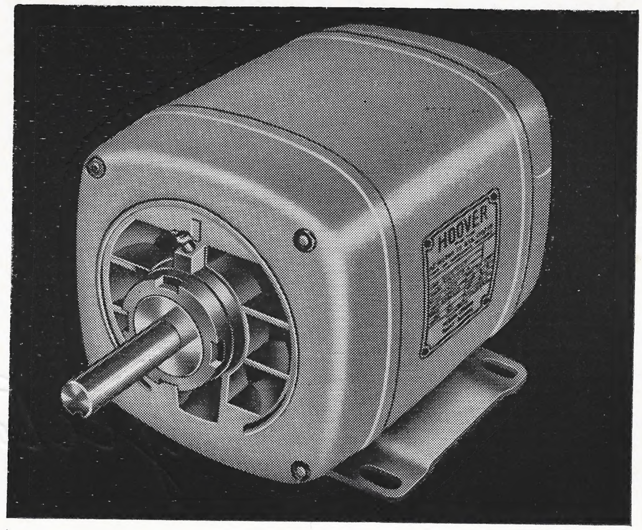

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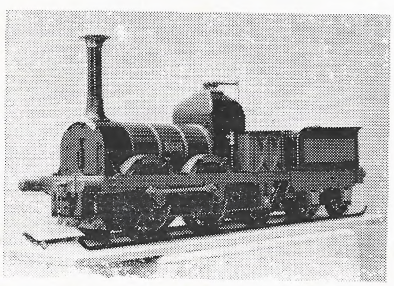

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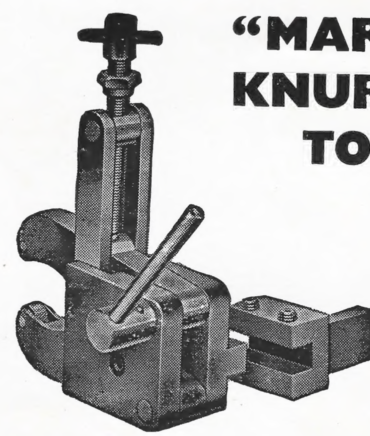

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Model Engineer

17 JANUARY 1957 VOLUME 116 No 2904

Subscription 58s. 6d. (U.S.A. and Canada $8.50) post free

Published every Thursday

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IN THIS ISSUE

NEXT WEEK

All correspondence should be addressed to the Editor, Model Engineer, 19-20 Noel Street, London, W.1.

SMOKE RINGS

A WEEKLY COMMENTARY BY VULCAN

As readers of the recent article on Eltham Green School [Boys at the Bench, December 27] are aware, modern education is making a conscious effort to meet the ever-increasing demand for engineers and technicians.

The extent of this demand has now been estimated by a body with a rather long-winded title: the Scientific Management Committee of the Advisory Committee on Scientific Policy. It seems that in the next three years more than 30,000 qualified scientists and engineers will be needed in Britain; which means that the annual output must be increased by over 60 per cent. in the next decade. By 1970 the present total will have to be doubled.

Economic pressure

This estimate applies to scientists and engineers, and obviously there must also be a very large increase in the number of technicians. Nearly every country has had to broaden its educational programme, more or less as a necessity of economic survival. Competition between the industrialised nations is growing constantly hotter, and so of course is the competition between the industries within each country. It is this which largely accounts for the demand.

Since the war the pace of scientific and technical change has accelerated enormously. In the next 10 years, for all we know, a single discovery may transform the industrial life of the world, or create new industries as yet unimagined. No report therefore can be more than a guide to action; but that, at the moment, is what the nation needs, and no one can glance through the Advisory Council's report (H.M.S.O., 1s. 6d.) without agreeing that Britain must have, as soon as possible, many more schools as comprehensive in their curricula as Eltham Green.

Saving fuel

Since the Suez crisis diminished the oil supplies to Britain, industry has been looking thoughtfully at its boilers. How can steam production be reduced in relation to each pound of the product ? Is it possible to make an existing boiler supply enough extra steam for an extended plant ? This is the kind of question which experts of the National Industrial Fuel Efficiency Service are busy answering throughout the length and breadth of the country.

In one factory, on the recommendation of the N.I.F.E.S., about 6,500 gallons of fuel will be saved in a season by replacing a small boiler by a larger one; in another, at Finchley, 46 tons less coke will be ordered this year through the adoption of a method of overnight banking.

Two Lancashire boilers were found

SMOKE RINGS . . .

on test to have an efficiency of 60.5 per cent. They will now use less than three-quarters of their normal 1,300 tons a year, for the suggested improvements will lower fuel consumption by a percentage of 26.8. Already from six to seven tons a week has been saved through a single recommendation. Every ton or gallon of fuel saved is, of course, a ton or gallon freed for other users.

The N.I.F.E.S. experts on their factory visits take the draught readings and flue gas temperatures and analyse the flue gases leaving the boiler. But some of their recommendations relate, it seems, to the obvious. As an example, a factory may never think of lagging its steam pipes until the N.I.F.E.S. man calls and calculates the saving in fuel, by this means, at 6,000 gallons of oil a year !

Cutty Sark's boats

FROM Frank G. G. Carr, chairman of the *Cutty Sark* Society's technical and rigging committees, comes an appeal for help in solving what is almost the last of the society's restoration problems. It concerns the four ship's boats to complete the clipper's original equipment.

The society wants, if possible, to avoid the costly expedient of building. But so far it has failed to discover any boats of the appropriate types and dimensions which could be used for re-equipping the ship.

Henry Henderson who, in 1870, sailed in *Cutty Sark* as her first carpenter, entered the dimensions of the boats in his notebook. They are:

	Length	Beam	Depth
Two lifeboats ..	25 ft	6 ft 6 in.	2 ft 9 in.
One jolly boat ..	22 ft	5 ft 9 in.	2 ft 4 in.
One gig ..	24 ft	5 ft 2 in.	2 ft 2 in.

Now where can such boats be found ? The society is willing to make a monetary offer for the craft though, naturally, it would welcome such acquisitions as a gift.

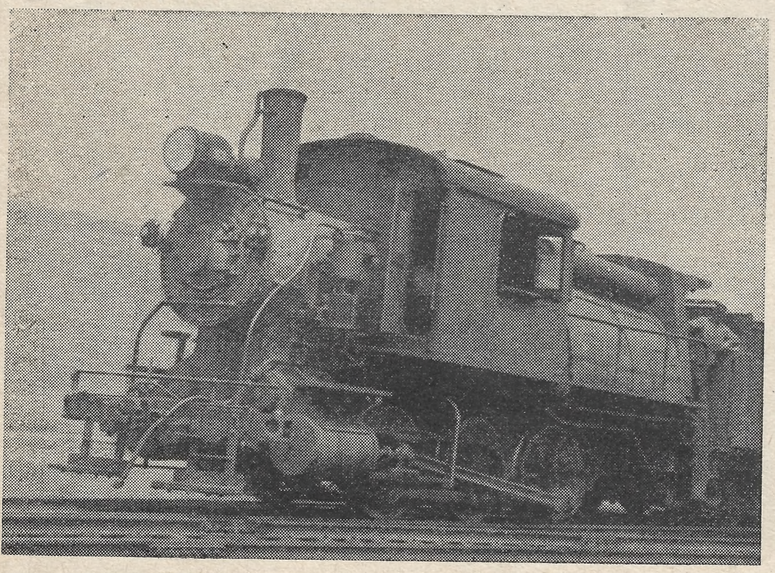
Basil Lavis

THE sudden death of Lt-Cdr Basil Lavis, on December 17, was a grievous shock to his many friends and acquaintances, especially those whose interests are with ships and the sea, for Lavis was a recognised authority on maritime matters, and was a frequent contributor to *Ships and Ship Models*.

For many years, he was a familiar figure at the Model Engineer Exhibition, which he served so well as steward, judge and announcer on the marine tank. His enthusiasm for marine models was infectious; his judgement of the competition entries was sound and authoritative, and his industry at the microphone of the marine tank made him known to hundreds of fellow-enthusiasts.

Above all, his inherently sunny nature, friendliness and never-failing courtesy endeared him to his colleagues, by whom he will be sadly missed. He had retired from active naval life in 1946, and since 1947 he had been assistant librarian of St Paul's School, and he was engaged in his duties there when his end came so suddenly and unexpectedly.

An 0-6-0 switch engine of the Central Railroad of New Jersey at Wilkes-Barre, Pennsylvania. Because the fireman and driver, in separate cabs, were too far apart this engine was outlawed long before the diesel era



Cover picture

The president, William Jones, with a youthful fireman aboard, driving BILLY JONES *on the Wildcat Railway, at Los Gatos, U.S.A.* *See the story on page* 101.

Oiling two-strokes

MY paragraph concerning overoiling in two-stroke engines brought in a prompt and mixed response.

There were those who advocated even less oil in the petroil and there was the other school of thought who firmly maintained that an extra ration of oil just to be on the safe side was a must for long engine life.

One critic maintained that underoiling encouraged the formation of rust on cylinder walls and bearings but I cannot agree with this. Rust, in any engine, is invariably caused by condensation and the only cure is a really good long run—say, 100 miles non-stop.

This will make the engine really warm and the considerable amount of water in the engine will be boiled and ejected through the exhaust in the form of steam.

More colour in W.R.

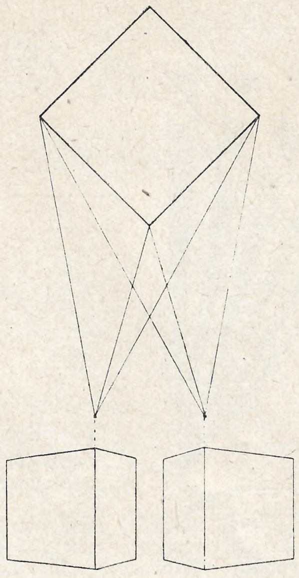
FOR about two years now, the Western Region of British Railways has been gradually extending the use of green as the colour for its locomotives. Previously, this colour had been used for the principal express passenger engines, including the Kings, Castles, Stars and Counties; some 12 months ago, it was adopted as standard for the Halls and Granges, and later for the Manors.

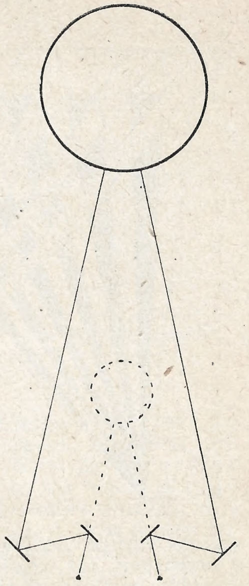
On the morning of Thursday, December 20, the 2-6-2 tank engine No 6169 was noted at Paddington, just out of the shops after a badly needed overhaul, painted green and fully lined out in the standard black and orange lining. This is the first time that an engine of the 61XX class has ever been lined out.

No 6169 certainly looks very well and it is to be hoped that she can be kept clean and also that the new colours will eventually be applied to the whole class.

Stereo-photography in action

By Geoffrey I. Lilley





Right, Fig. 1: Diagrammatic explanation of the principle of stereoscopy

Extreme right, Fig. 2: Showing the principle of the telestereoscope

THE construction of a few simple pieces of equipment opens up the vast field of stereoscopy to those who possess a camera.

The utility of stereo-photography is not confined to amusement. Stereo slides of a series of printed words that appear to approach the observer from infinity have been used for training the eyes in cases of strabismus and other defects of the sight.

Even the moon can be portrayed in stereo. Although it is commonly believed that the moon always presents the same side to the earth this is not precisely so since its orbit is elliptical, and it therefore appears to oscillate slightly. Hence two photographs of the moon taken several days apart will exhibit a stereoscopic effect.

Binocular sense may be employed to detect slight differences in two apparently identical articles. Each article is photographed from precisely the same viewpoint and a print or transparency of each negative is mounted in a stereoscope to which has been fitted a green filter over one eyepiece and a red filter over the other. The eyes would normally fuse the two complementary coloured images into a single black and white image, but where a difference occurs the part concerned appears in colour and is readily apparent. This process has been used in the past for such things as determining the movement of the enemy in war time and the detection of new stars.

The principle of stereoscopy (illustrated in Fig. 1) is well known, and many novel devices have been designed for producing a stereoscopic effect.

There is, of course, a distance beyond which no relief is discernible, but this distance can be increased considerably in stereo-photography by using a large base. Fig. 2 depicts the principle of the telestereoscope, which utilises a system of mirrors for increasing the base of the viewpoint. The dotted lines show the point at which the object appears to be situated. Prismatic binoculars are another example of the large-base technique.

The parallax-stereogram produces a stereoscopic effect without the use of a stereoscope. This process was developed in 1903 by F. E. Ives and the principle is shown in Fig. 3. The stereogram is printed from an ordinary stereo pair through a grating in such a way that when viewed through a similar grating each eye sees only the strips that constitute one picture. In practice the strips are very narrow and the discontinuity is no more conspicuous than that of a half-tone magazine illustration.

The anaglyph is a popular stereo device and is sometimes used to illustrate magazines. In this process the two pictures are superimposed on to the same base and printed in two complementary colours—say, red and green. Although the image is confused when viewed with the naked eye the stereoscopic effect is obtained when viewed through a pair of spectacles, one glass of which is red and the other green.

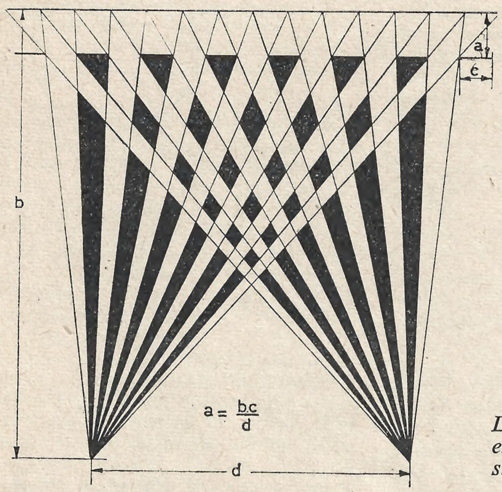
The vectograph is similar in principle to the anaglyph but instead of using differently coloured images, which do, incidentally, cause a certain amount of eye strain, the two images are projected through two polarisers suitably orientated and viewed with polarising spectacles.

An ingenious but rather complex system known as strobostereoscopy has apparently been patented several times and has actually been on show in Paris for a run of several months. The two images are alternately projected on a screen and each viewer is provided with a pair of glasses fitted with electro-magnetic shutters which are synchronised with the projectors, thereby ensuring that each eye will see only its correct image !

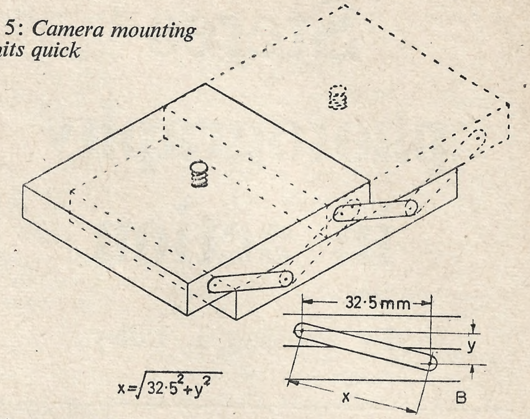
An unusual process which the amateur photographer can tackle without special equipment is known as photo-stereo synthesis. This process does not actually involve stereoscopic principles, but the effect is startling if the work has been carefully carried out. A fairly close-up subject is photographed several times with the lens stop wide open to ensure a very small depth of focus. After the taking of each picture the camera is moved forward slightly. The series of photographs is then printed very lightly on positive transparency plates, the degree of enlargement being such that the ratio of the thickness of the plates to the image size is the same as the ratio of each camera movement to the object size.

The plates are then carefully bound up together in correct order, care being taken to ensure perfect register. This composite transparency will produce a powerful sensation of relief when viewed from the correct position.

Any camera may be used for stereo-photography if it is provided with some means of shifting it about 65 mm. at right angles to the optic axis of the lens. Exposures made in the two



Left, Fig. 3: Diagrammatic explanation of the parallax-stereogram printing method



Right, Fig. 5: Camera mounting which permits quick operation

stations thus provided will constitute a stereo pair, for which mounts are available in standard sizes enabling the picture to be viewed in a standard stereo viewer.

Twin-lens stereo cameras *are* manufactured, but they are rather highly priced and though they make possible the stereo-portrayal of moving objects their usefulness is limited in precisely the same way as an ordinary fixed lens camera—they can only be used for " conventional " photography.

Under certain circumstances it may be desirable to depart from the standard base of 65 mm. (i.e., the average spacing of the eyes) and make the pair of exposures from two points several feet apart. Then again if the object to be photographed is very small—thereby necessitating a really close-up viewpoint—it would obviously be impossible to use the 65 mm. base since the two photographs would portray totally different scenes !

It is clear then that the most versatile equipment for stereo work consists of an ordinary camera—preferably one of long-bellows type or a 35 mm. with a good range of accessories—fitted upon a stereo attachment. This will have the one disadvantage that its use must be confined to the protrayal of inanimate objects, although of course it *may* be possible to make stereo pairs of objects that are likely to move but may not do so, bearing in mind that the second exposure may not get taken in time.

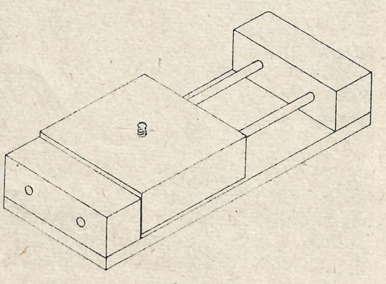
For general stereo-photography a base of 65 mm. should be used and several different devices for making the necessary movement between exposures are shown in Figs. 4, 5 and 6.

That shown in Fig. 4 is a simple sliding block mounted on two runners. Its size depends largely on the camera it is to accommodate, the only essential dimension being the one marked. A tripod bush, tapped ¼ in. Whitworth, should be fitted to the centre of the underside and a ¼ in. Whitworth stud for holding the camera should be fitted to the centre of the top surface of the sliding block. Some means of clamping the camera in position could be incorporated, but this is hardly necessary if the block is a good sliding fit.

The attachment shown in Fig. 5 is probably faster in operation. Speed is an advantage if there is a possibility for the object being photographed to move. The length of the arms for any given thickness of platform may be calculated quite easily by the method shown in Fig. 5b.

Fig. 6 shows a de luxe model which, although slower in operation, has another important use for those interested in close-up photography. If the camera is mounted with its optic axis parallel to the line of movement, the attachment can be used as a focusing mount. Most close-up enthusiasts know how much easier it is to focus upon a close-up object by moving the whole camera backwards and forwards rather than just the lens. This model requires a

Fig. 4: Simple sliding block for mounting the camera

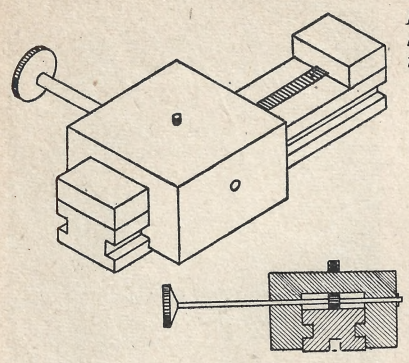


lining of felt on the top surface in order to hold the camera firm while retaining sufficient play to allow for a further quarter turn of the camera. Naturally, it is desirable to line any camera support with felt or baize to protect the camera base.

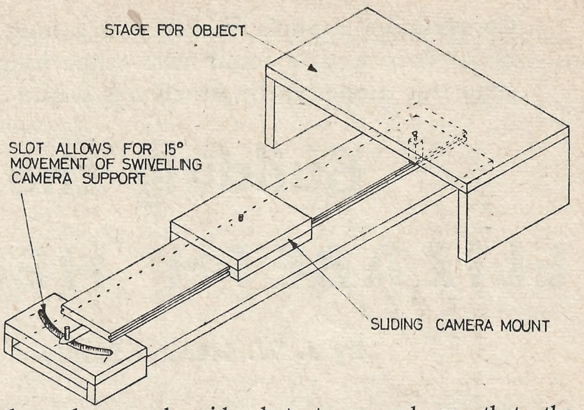
The requirements for the portrayal in stereo of really close-up objects are slightly different. Since a movement of 65 mm. would probably place the object completely outside the field of view, it is necessary to rotate the camera round the object instead. To achieve this a special stereo bench is required, which should be so constructed that the object may be placed on the stage directly above the fulcrum of the swivelling camera support (Fig. 7). The camera itself is fitted to a sliding mount by the usual ¼ in. Whitworth stud. The curved groove cut in the camera-support guide should allow for the side-to-side movement of 15 deg., and the central position could be marked out on the guide for straight photography. It would be an advantage to provide a background board of some sort with one side black and the other a medium grey tint.

The size of this unit will depend entirely on the camera it is to accommodate. For instance, the length between the top surface of the sliding camera mount and the top surface of the stage should be a little less than the distance between the base of the camera and its optic axis, but if the camera is fitted with a rising front which drops a little—as they mostly do—the distance could be decreased still further. So much also depends on what the apparatus is to be used for. The length of the baseboard could be almost anything, but the minimum practical length will probably be around 3 ft in most cases.

Having constructed the chosen attachment it now remains to decide when and how it may be used. For instance, there is little point in



Left, Fig. 6: A de luxe method of fixing the camera



Right, Fig. 7: The method employed to deal with close-ups

making a stereo pair of a distant landscape with the aid of one of the attachments shown in Figs. 4, 5 and 6 since the sensation of relief in such a stereogram would be almost entirely lacking—the best part of the subject would be beyond the range of stereoscopic vision.

The range of stereoscopic vision may, however, be increased by increasing the base.

Large-base stereo photography can produce some interesting effects which, though normally regarded as defects, may be produced for the sake of novelty. The trouble is caused by the fact that it takes a certain amount of time to get set up at the second station—time in which things have been moving. . . .

On a windy day any clouds will have moved considerably and the effect of this in the stereogram will be that the clouds appear to be closer than the landscape. The sun also moves, hence do shadows, and if much time has elapsed between exposures the stereogram will portray large black shadow masses looming higher and higher above the ground.

Generally, landscape stereo photography is more satisfactory when there are a few objects in the foreground and here the normal 65 mm. base attachment can be used quite successfully. The time between exposures is practically negligible and the parallelism of the two positions is assured.

The 65 mm. attachment will cover most " middle-distance " requirements but the point at which the two images cease to overlap sufficiently is determined by the camera; closer than this point a stereo bench is necessary.

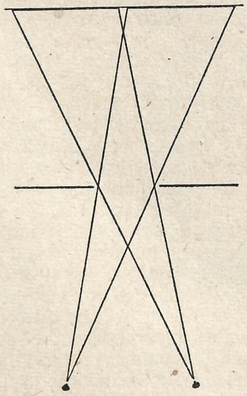
Stereo pairs are normally mounted in 4¼ in. or 4 in. slides and many of the viewers available are able to accommodate either of these sizes. For those who use a 35 mm. camera or, indeed, any other negative size when cut down, ready-made paper masks are available for 18 mm. × 24 mm., 22 mm. × 24 mm. and 30 mm. × 24 mm. formats.

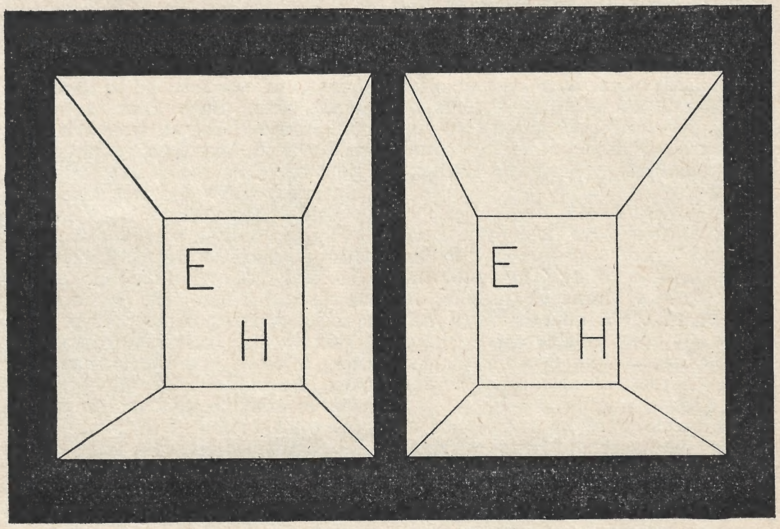
A simple and novel way of viewing a stereo pair without the aid of a stereoscope is shown in Fig. 8. The two photographs are placed side by side but transposed so that the picture which should be viewed with the right eye is on the left and the other picture on the right. A paper or card mask is then prepared with an aperture of, say, 1½ in. square and is held in such a position that the right eye can see only the left-hand picture and the left eye the right-hand picture. By squinting slightly the two images will merge into one and after a few seconds the eyes will be able to adjust themselves and focus upon the stereo image.

This method may be attempted on the drawing of the inside of a cube (Fig. 9). If this is drawn up to a size of 12 in. × 8 in., it will be seen when focused that the letter *E* appears to be suspended in space beyond the end of the cube while the letter *H* appears to be suspended inside the cube. It will be noticed that the two *Hs* are closer together than the two *Es*—considering the two pictures in their correct positions—and these letters viewed in their simple surroundings illustrate vividly the fundamental principle of stereoscopy. ▣

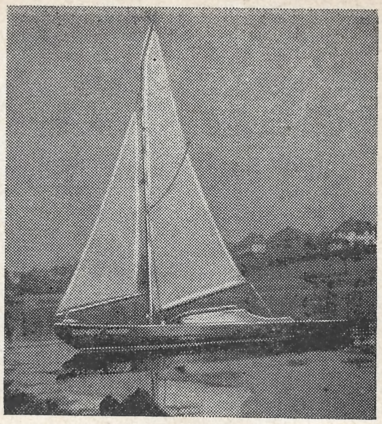
Right, Fig. 9: An experiment which illustrates the fundamental principle of stereo-photography

Below, Fig. 8: A simple way of viewing a stereoscopic pair





Constructing models can often be a long and tedious task. Few models could have taken longer to make than this model yacht which was begun 30 years ago



Building the ELIZABETH HENSON

By J. W. Henson Bamford

ABOUT THIRTY YEARS ago an old gentleman I knew was very good to me. He lent me a laminated half-model of a yacht hull and provided me with quite a lot of materials for the building of a model.

From the half-model—it was about 18 in. long—I made a drawing by pencilling round the sections and then scaled this up and faired it up to give me a boat about 4 ft long. When I returned the half-model, my benefactor, on seeing my drawings, gave me the timber—sufficient ⅛ in. thick pine to cut off the planks, a block of mahogany for the counter, a grown bend of ash for the stem and I think some lengths of ash from which to make ribs. He may also have provided the length of pitch pine which I used for the keelson.

My tool kit was small and most of the work was done on the kitchen table. A length of 4 in. × 3 in. deal was obtained to serve as a building board. Temporary formers were cut from ⅜ in. deal, obtained from boxes, being made to allow for ⅛ in. planking and cut away to take the 1 in. wide keelson. The stem, the formers and counter-block were screwed to the building board. All pieces were on and off a number of times in the process of fitting the keelson (recessed into the counter block and scarved to stem) and bevelling the edges of the formers.

Securing the formers

The formers were held by a piece of 1 in. square stuff—the upper end being screwed to a former and the lower by two screws to the 4 in. × 3 in. board. The counter block had previously been roughly cut to shape and was recessed to take the planks. It was a mistake not to rebate the stem also.

The planks were cut and pinned in place, the garboard strakes first. Planks were paired up prior to fitting. Two more mistakes were made at this stage: the planks were made too wide through trying to minimise the number of joints; this entailed a lot of work later and proved to be false economy. Secondly, iron pins were used. I know better now.

All formers had been made to the underside of deck line and since in planking the sheer strakes had been cut to lie flush with the former corners the sheer was all in order. The hull was removed from the baulk and all formers but three taken out, one at a time. Those left were: the small one near the stem, one amidships and one some 12 in. from the counter.

As each former was removed a pair of steam bent ash ribs—section ½ in. × ⅛ in. were pinned in. The inwale, ⅜ in. square ash was put in in sections stem to former, former to former and so on, being cut just to clear the upper ends of the ribs. An inwale in one length would of course be much better. A strong crossbeam, with the upper face shaped to give the deck camber, was inserted immediately aft of the mast position and another beam cut away to clear the mast added, running forward to the stem.

The mast step

The forward end of this latter was tapered both ways to fit the sheer strakes and was screwed to these and to the stem. Both these beams, of American whitewood, were relatively massive and were later removed and lightened. A mast step of sheet aluminium and wood was made and screwed to the keelson.

For the deck I bought a piece of satin walnut finished ⅛ in. thick, 11 in. wide and just over 4 ft long. It cost me three shillings. The deck was cut a trifle oversize, camber strips were added to the former tops and the deck, after cutting the hole for the mast, was affixed by about half a gross of brass countersunk screws. A pole mast without fittings was made and this ended the first stage of the boat's construction.

In this condition it was included in the first public exhibition of the newly-formed Coventry M.E. Society.

Now a confession: the fixing of the wooden fin keel was beyond me and progress on the boat stopped. It stopped for a long time—over 20 years. During that time I built several smaller boats, a small schooner, a Thames barge (10 in. long and a good sailer), a sailing semi-scale model of a Siamese Lorcha, a sailing outrigger canoe (no metal used and total material cost twopence) and a miniature racing yacht, 12 in. overall, with a Braine gear that functions.

In 1927 I bought the hull of an old-fashioned cutter of beautiful lines. This I have rigged with three complete and varying sets of mast, spars, fittings and sails. I must admit that I started, and for various reasons left unfinished, several other boats including a miniature sailing model brig, a bread-and-butter barquentine (48 in.) and another Thames barge.

The building and flying of several sailplanes and rubber-driven aircraft occupied quite a lot of time, for I never built any quickly and skimpily. Eventually, in 1947, the call of the "E.H." won through and I set to work to get her in sailing trim.

Coventry has very poor facilities for model sailing and there was then no model yacht club and no organised sailing, so I decided to make the boat a cruiser by building in a cabin and installing an electric auxiliary drive.

Adjusting keel weight

I won't inflict on the reader a detailed account of the fitting of the fin since the difficulty would not have arisen had the boat been fully planned at the outset. The greater part of the fin and the pattern for the keel were made from two pieces of 1 in. thick American whitewood which had been saved from pre-war for this purpose. These were drilled through to take the two ¼ in. brass bolts which secure keel.

Due to an error in estimating the density of the pattern the keel when cast was lighter than intended but

the addition of a half-round brass strip all along the bottom has brought the keel weight to nearly 6 lb. The lead was drilled and tapped for the bolts, there being $\frac{3}{4}$ in. of engagement on each. Interspersed with the bolts are three large round-head wood-screws down through the keelson into the fin. Under the heads of bolts and screws are large washers, in my opinion a necessity.

The former amidships was in the way of the cabin and was therefore removed and a fairly substantial built-up rib was substituted.

To describe the cabin and well construction would take too much space so I will compromise with a few notes.

Obechi was used for the greater part of the structure. Each cabin side was made in one with the well side $\frac{1}{8}$ in. thick. Cabin roof, hinged at the forward end, is planked up on a built-up frame. Since the roof curves both ways, planks are shaped to fit and are about $\frac{3}{8}$ in. mean width across the top and $\frac{3}{16}$ in. at the sides, all 3/32 in. thick.

The dummy sliding access hatch is of satin walnut (part of the large piece cut from the deck to clear the cabin and well). The bulkhead between cabin and well is framed up of $\frac{3}{8}$ in. square stuff and panelled. The well floor is in three pieces, the central one giving access to the propeller shaft below. Each are of $\frac{1}{16}$ in. obechi, cross-battened below and with narrow treads Durofixed to the upper face.

The motor

A Meccano motor with a 3 : 1 reduction to a $1\frac{1}{2}$ in. dia. propeller and dry batteries were fitted and used but have since been removed and temporary ballast added.

The addition of the cabin has made the boat look like a boat and while sailing her I have heard a lot of favourable comment. I think the cabin, though inconvenient in some ways, detracts very little from the boat's performance.

Initially rigged as a ketch, both masts were curved (laminated). Sail area was just over 1,000 sq. in. Sheets were led to the well. Under this sail she often shipped water and a celluloid cover was fitted over the well.

The addition of $\frac{3}{4}$ in. on length would bring her within Marblehead limits. As I was pleased with her performance I decided to re-rig for 800 sq. in. The new rig included a wishbone gaff for the mainsail. This is sheeted from the top of the mizzen mast by what I rightly or wrongly call the vang and is adjusted by a bowser on a jack line on the after-side of the mizzen mast.

The two curved arms of the gaff are laminated and were formed on the jig used for the curved masts. The top mast, much shorter than the earlier one, is made of alternate layers of obechi and mahogany. The small gaff mizzen is not set with the main but in place of it in heavy weather.

Sprung bumper

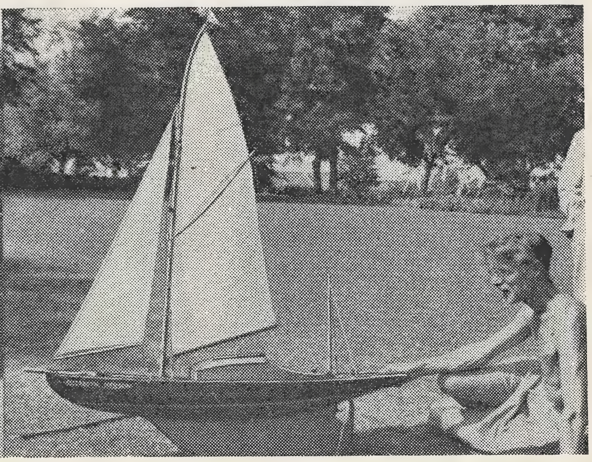
The bowsprit-like bumper is loaded with a pair of tension springs. A wooden stop limiting the bumper travel to $1\frac{1}{2}$ in. was driven off when the boat hit the concrete side of the pool; this when sailing under fore and mizzen only. The stop was screwed not just to the deck but through to the beam below.

Lime was used for the deep rudder which is raked 10 deg. Steering gear is of the Braine type with a straight tiller; the latter, due to the run of the sheets, being necessitated by the cabin and well.

I can say nothing of the merits and de-merits of the wishbone gaff rig, for two reasons. First, to make a comparison, two similar hulls with sails of a given area, one of standard type the other wishbone, would be necessary. Second, the pool in Nauls Mill Park, Coventry, lies in a tree-screened hollow. The wind there, when there is any, is variously described as "from the usual three directions" and "circular."

However, if any readers have made comparative tests with sail—surely some have—I think that reports, even if adverse, would make interesting instructive reading. ■

ELIZABETH HENSON *glides across the lake*



The author with the completed yacht

Unusual locomotives—7

ICE and LOG RAILWAY ENGINES

ERNEST F. CARTER describes a railway peculiar to the Frozen North

THE ORDINARY steel track railway is often completely disorganised—particularly in some parts of the world—by the forces of winter when the locomotives are at times unable to drive a way through piled snowdrifts, and signals and points are frozen solid.

There is, however, a certain type of railway—if such a term can be applied to it—which is inoperative unless the ground is both snowbound and frozen. It is the "ice railway" used in the lumbering districts of Canada and the United States.

Strictly speaking it is not a railway, since the vehicles do not run along a pair of rails, but none the less it demands a defined track formed by two parallel ice-covered ruts along which a hybrid locomotive, a combination of a railway engine, a traction engine, and a steam-driven motor car runs with a train of vehicles mounted on long sledges or runners which faithfully follow the ruts.

It was the Phoenix Manufacturing Company of Eau Claire, Canada, who contrived a locomotive which can travel as easily over ice as its railway brother can be driven over the steel highway, and after innumerable peculiar constructional problems had been solved they sent an ice locomotive into the Wisconsin forests to determine how far it could compete with animal traction.

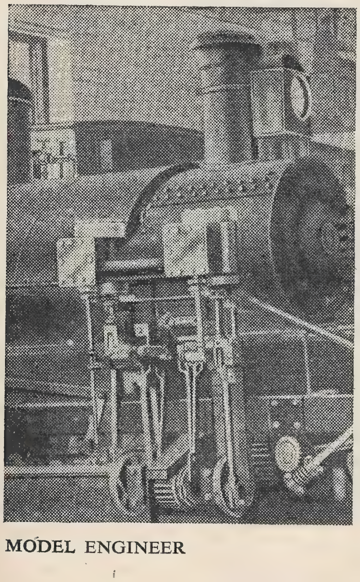
The experiment was a complete success, for steam haulage over the frozen ice-ways proved so superior to horse traction that the demand for such locomotives doubled and trebled Phoenix's output. The future of the ice locomotive was assured, and the original engine was so improved that its use became more or less universal and formidable trains of sleds, each laden with 15,000 ft or more of timber, were to be seen in use.

The boiler, of the standard locomotive type, was designed for a pressure of 200 p.s.i., and was 15 ft long by 3 ft dia. being mounted upon a heavy reinforced channel-steel frame. It was an easy steamer and economic of fuel, being adapted to burn either coal or wood—a vital factor seeing that coal invariably is a very costly item in lumbering districts.

The engine itself was carried upon a leading "bogie" comprising two runners or sleds, and at the front end, ahead of the smokebox, was a large steering-wheel with a seat for the steersman who carried out his duty upon the broad lines of a car driver. The driving or traction device recalls the caterpillar tractor, there being a $4\frac{1}{2}$ in. dia. steel shaft on each side of the engine which carried two massive steel runners or tracks driven by steel sprocket wheels. The treads were 12 in. wide and 14 ft long.

The steam-engine itself had four $6\frac{1}{4}$ in. by 8 in. cylinders, two cylinders being disposed on each side of the boiler, and from them power was transmitted to the driving tracks by a spur pinion mounted on the crankshafts and another mounted on the

Below: Starboard power unit of the Phoenix ice locomotive



Below: A Phoenix ice locomotive preparing to set off with a heavily loaded timber train behind the drawbar. Passengers distribute their weight over the sled "bogie"

front end of the driving shafts; bevel pinions on the latter meshed with larger bevels carried on the ends of the rear driving axles.

The cab fittings were of the usual locomotive type, and in running order the engine weighed about 19 tons, about 100 h.p. being developed with steam at 200 p.s.i. and an average speed of from 4 to 5 m.p.h. being maintained over reasonably good "track." Under normal conditions one such locomotive could haul a train of 15 vehicles on a road of 8 ft gauge, loaded with from 10,000 to 20,000 ft of timber. The overall width of a loaded sled-vehicle was easily 16 ft !

Successful operation was governed by the care expended upon the preparation of a frozen road with easy curves and grades. By the careful distribution of water in the track ruts, such a road could be easily formed in which the ruts resembled two parallel sheets of ice upon which heavy loads could be hauled at a good speed at the expense of $1\frac{1}{4}$ tons of steam coal for a 10 hour run.

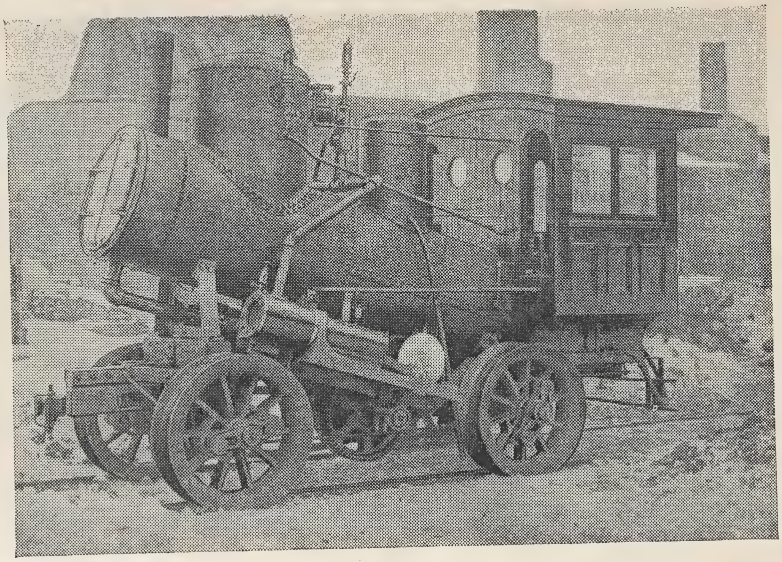
It is interesting to note that Messrs Neilson and Company, of Glasgow, exhibited at the International Exhibition of 1862 the locomotive "Rurik," which was designed by Nathaniel Grew for use on the River Neva between St Petersburg (Leningrad) and Kronstadt; where it successfully hauled freight and passenger traffic, and bade fair to become very useful on the frozen rivers and great lakes of Russia.

This 12 ton locomotive boasted two 10 in. × 22 in. cylinders and driving-wheels 5 ft dia., the latter being studded with steel spikes to increase adhesion. Steering was achieved by shifting the front sleds by a worm and wheel which worked on a rack on the sled bogie. A $\frac{1}{8}$ in. scale model of this engine, made by Mr Grew, is still to be seen in South Kensington Science Museum, London.

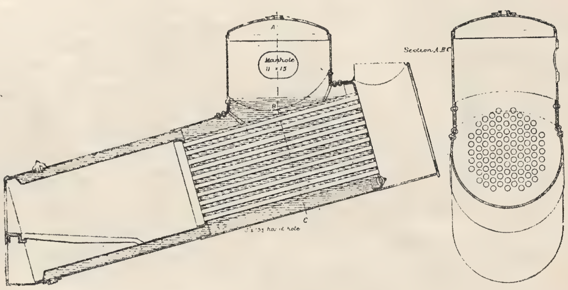
Log " rails "

Another interesting and unusual locomotive was that designed to travel on log "rails," and is an example of how far novel locomotive designs would depart from the orthodox to meet the novel conditions brought about by the recession of the immense forests of North America and the consequent lengthening of the lines of communication between them and the sawmills.

The locomotive was designed and built in 1903 by the Robb Engineering Company, of Amherst, N.S., for Emile Stehelin, a French migrant in the lumber business and upon whose estates it hauled trains over 15 miles of track laid with timber "rails" from the adjacent forests.



Above: The Robb log rail loco of 1903



Right: Section of boiler of Robb log rail steam engine

The boiler, 3 ft 4 in. dia. and 10 ft 6 in. long, had its smokebox set 2 ft higher to assist water circulation and fire draught, and was supplied with 109 × 2 in. tubes 5 ft long. The firebox was arranged for wood burning, being 2 ft 10 in. wide × 5 ft 6 in. long, and steam collecting space was provided in the forward large dome which was 3 ft 4 in. high and 3 ft dia. With a total heating surface of 316 sq. ft, the engine was a ready steamer, the boiler being pressed to 125 p.s.i.

The 3 ft driving-wheel treads and flanges were made to conform to the wooden rails, the treads being conical and the flanges double. The cylinders were 9 in. bore × 10 in. stroke and drove on to disc cranks, balanced valves and link motion being fitted. The engine shaft was fitted with a steel pinion which geared at 4 to 1 with an intermediate shaft carrying sprocket wheels which drove by way of steel chains to the driving-wheel axles.

With an unloaded weight of 11 tons, the locomotive was mounted on comparatively sensitive helical springs to minimise shock on the very uneven track upon which it travelled. ▣

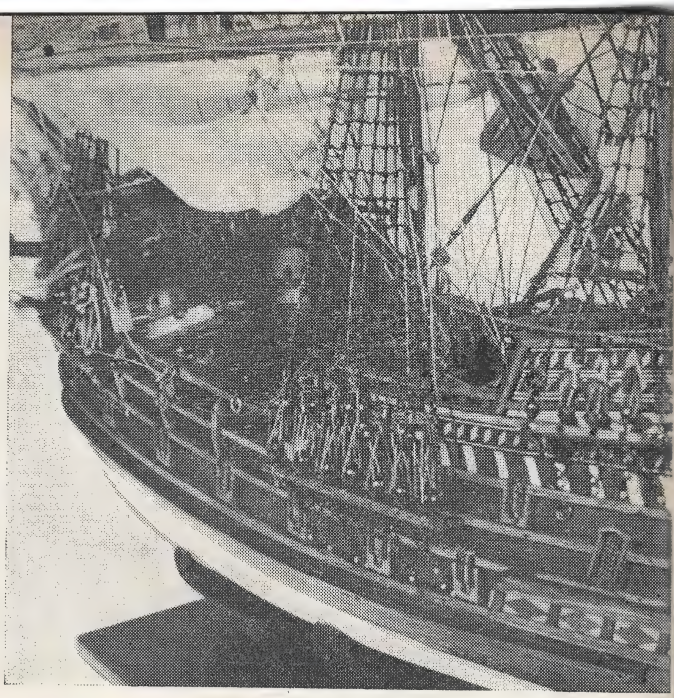
DISC BRAKES FOR BRITISH RAILWAYS

BRITISH RAILWAYS are to carry out full service trials in the Southern Region with a 10-coach electric train fitted with disc brakes similar in principle to those on racing cars.

The use of disc brakes for railway vehicles is an entirely new departure from current practice in Great Britain. At present the braking of railway vehicles is effected by blocks, usually cast iron, pressing on the tread or running surface of the wheel. In the case of suburban trains requiring frequent stops, wear on the blocks is heavy resulting in frequent renewals, and on electric trains the iron dust caused by the rubbing of the blocks is detrimental to electrical equipment on the bogie.

The disc brake is operated by the normal air brake control through a brake cylinder controlling a pair of calliper levers having non-metallic thrust pads on the inner ends, which in turn grip the side surfaces of a disc mounted on the axle behind the bogie wheels. ▣

Some readers' models



A review of some of the work undertaken by M.E. readers

My model of *Invicta*, shown on the next page, has been a constant source of amazement to me (and others), with its astonishing performance.

The castings, including valve and injector bodies, were made in gunmetal by myself. All driving wheels have lacework spokes, both because I like the look of them and also because only one pattern was necessary. They are in gunmetal with steel tyres pressed on.

The main and rod bearings are Torrington needle bearings working on heat-treated axles and shafts. All valve gear wearing parts are heat-treated oil-hardening steel.

Making the pressure gauge was quite enjoyable. As it is centre reading, I used a pinion and gear section from a woman's wrist watch. A globe seat type throttle valve has replaced the plug type as I found this to be a little too sensitive for nice control.

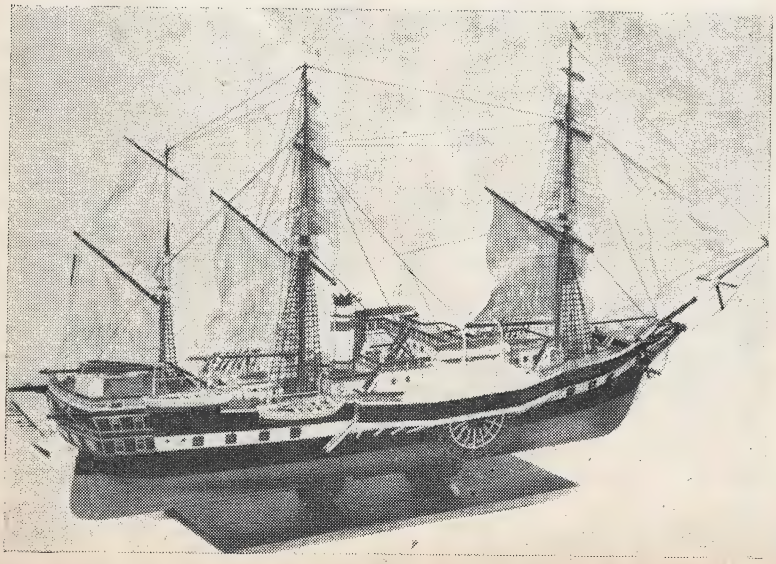
The two injectors are a joy to operate. The one on the left was built to the injector design for L.B.S.C.'s *Maisie* and the right-hand one from *Britannia* instructions. Both have 68-72-76 cone sizes. These little injectors are wonderful to help keep the safety valve from blowing continuously.

I was reluctant to place lead between the frames to give added traction, but when I read that a railroad in this country did this to some of their very large engines I went ahead and did likewise. As a result I was able to get $7\frac{1}{2}$ lb. of lead between the frames in such a manner that it did not show objectionably.

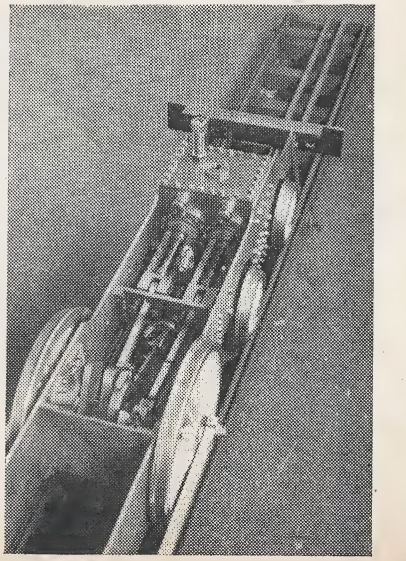
There is no axle pump on the engine. It has pulled as much as 440 lb. on a continuous track with grades. Also it has pulled 400 lb. up a 2 per cent. grade from standing start on a slightly lesser grade. The rail being aluminium needs sand to prevent slipping with such a large load.

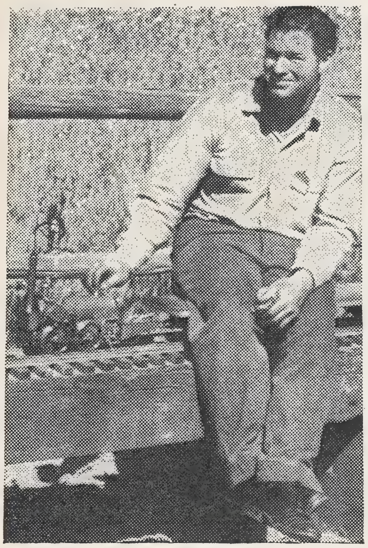
Invicta burns domestic coal which gives off a realistic smoke and it has run as long as 5 hours. Boiler is easy to clean, a rod is used occasionally to clear the cinders that lodge next to the blast nozzle. Cylinder drain cocks are as described for *Maisie* only much smaller ones were added and are

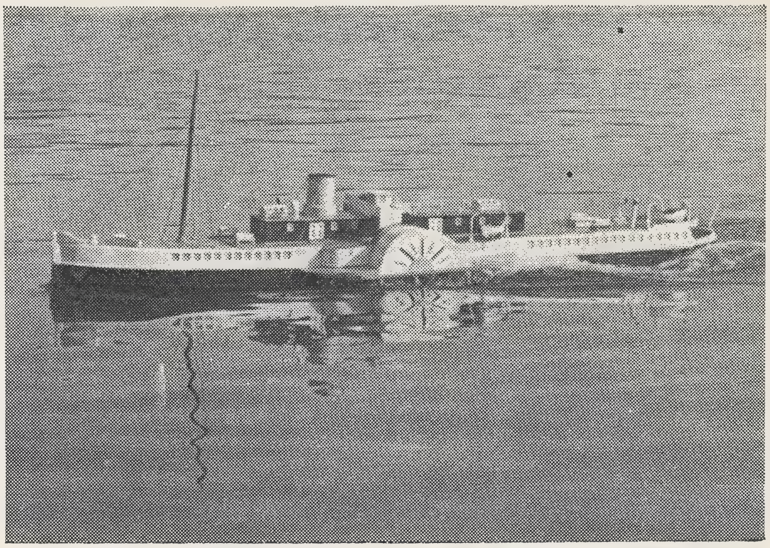
The French frigate (below) and the Elizabethan galleon (above) were built by Vincenzo Luisci, of Florence, Italy



Below: Looking down on the MAID OF KENT *chassis, showing the inside cylinders, valve gear and connecting rods*







operated from the backhead. All that is lacking is some engine details and tender.

With the experience gained from little *Invicta* I plan to build the Consolidation 2-8-0. I plan to use air brakes, using a duplex pump to supply air. A turbo generator would also be added.

OSCAR M. HEUTER.

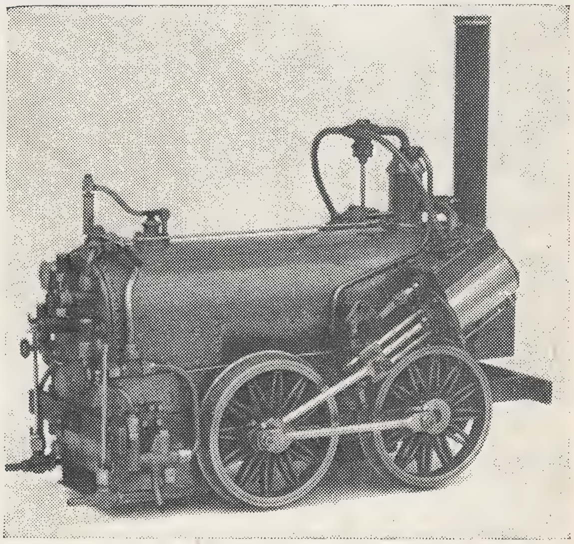
THE L.B.S.C. model *Maid of Kent* is being built by a small section of the Weymouth and District M.E.S. under the leadership of Mr G. Grundy.

The photographs were taken by Mr Beavis and Mr Coulter, both members of the society.

H. W. G. SWINDELL.

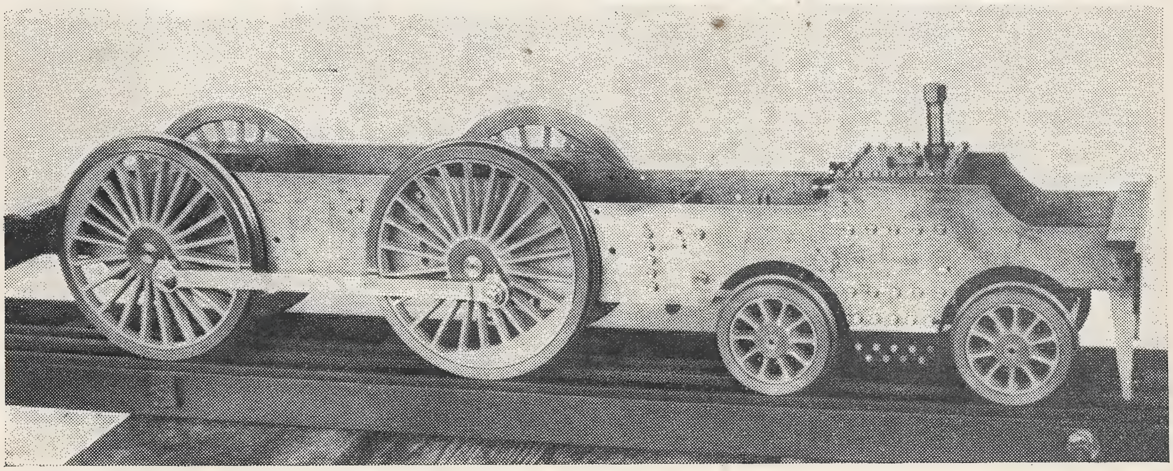
Above, right: This 8 ft 6 in. paddle steamer was built by P. J. Boyce, of Portsmouth. It is driven by a twin-cylinder engine working at 60 lb.

Above, left: Oscar M. Heuter riding on the car he built to a design which appeared in MODEL ENGINEER



Right: Mr Heuter's sturdy little INVICTA

Below: Side view of MAID OF KENT *chassis*



PLASTICS in model engineering

By EDGAR T. WESTBURY

Synthetic adhesives and cements — conclusion

Continued from 3 January 1957, pages 12—14

IN the first article in this series it was stated that one of the earliest commercial applications of synthetic resins was in connection with paints, varnishes and adhesives; and despite the fact that in later years the development of solid plastic materials has been the more rapid and spectacular, research into the former possibilities of these materials has by no means been neglected. It may, indeed, be said that practical work in this department of plastics has had just as far-reaching results as in that of solids.

There is a fairly obvious analogy between the synthetic resins and natural gums, resins and so-called "drying oils," mostly of vegetable origin. Some of these are comparable to thermoplastics, being capable of softening by heat, or dissolving in volatile spirits, while others undergo a chemical change in the course of drying, rendering them thereafter insoluble, and in this respect resembling thermo-setting plastics. Nearly all these natural products have been employed to some degree in making adhesives and cements, so it is logical to assume that the synthetic products present similar possibilities.

In common with the cobbler who declares "There's nothing like leather," the carpenter and joiner generally believes that no adhesive can possibly equal good Scotch glue; but in both respects, the developments in modern plastic materials are rapidly rendering the old slogans out of date.

I do not propose to discuss paints and varnishes in these articles, beyond saying that the "synthetics" have made rapid strides, both in their quality and extent of application; they can now be obtained in varieties to suit all purposes, and are not merely substitutes for the older compositions, but often supersede them in convenience of working, quick drying, hardness of surface, and resistance to water, oils and chemicals. Most readers, no doubt, have heard of the new plastic paints, the special properties of which eliminate the dripping of paint from the brush, which is the bugbear of the amateur decorator.

THERMOPLASTIC ADHESIVES

Several well-known adhesives have for many years now employed nitro-cellulose as a basis; these can be distinguished by the characteristic smell of pear drops—in other words, amyl acetate. The same ingredients, of course, are familiar in their application to feminine adornments, in the form of nail varnish. Many of these preparations utilise waste celluloid, such as obtained from the base material of old cinema films, and it is interesting to contemplate that the cement which one uses to fabricate the fuselage of a model aircraft may once have borne the silver-gelatine image of one's favourite film "pin-up,"

To a lesser extent, cellulose acetate and butyrate are also employed in making adhesives, and their non-inflammable properties may offer advantages for certain classes of work. Both types of cellulose compositions are usually very quick-drying, depending on the solvent employed or the presence of additives designed to avoid brittleness when the solvents have dried out.

Vinyl derivatives have useful properties as adhesives, and are particularly well suited to bonding plastic materials to metal, glass or ceramics. Polyvinyl chloride is sometimes used in combination with polyester or epoxy "self-curing" resins for this purpose, as in the Vinagel adhesive pastes.

CASEIN GLUES

The use of casein as the main ingredient in waterproof adhesives is familiar to constructors of model ships and boats, in particular, but it is applicable to all kinds of woodwork, and its advantages are so well known that no further comment is required.

There are several proprietary casein glues on the market, all of which are easy to use, and will give good results if the makers' instructions are followed. They must be mixed with water immediately before use, as they cannot be kept in a liquid state, but set solid within a few hours.

THERMO-SETTING ADHESIVES

The properties of phenol resin, melamine, urea and other synthetic resins in this class can be utilised as adhesives, and the fact that they become incapable of re-softening under any circumstances after curing, renders them extremely valuable for permanent fabrication of wooden or plastic structures.

One of the most important modern applications of these resins is in the bonding of plywood; the original use of natural glues for this purpose is now completely obsolete, and the synthetic adhesives not only render the laminated wood waterproof, but also increase its strength considerably.

One of the best-known adhesives used for this purpose in Britain is Beetle, which has a melamine base, and another, equally well-established, is Cellobond (Group 1) adhesive resin. A very important property of synthetic resins in woodwork fabrication is that it offers a strong resistance to bacteriological, fungoid or insect attack, and structures in which it is used are thus immune from dry rot, woodworm, etc.

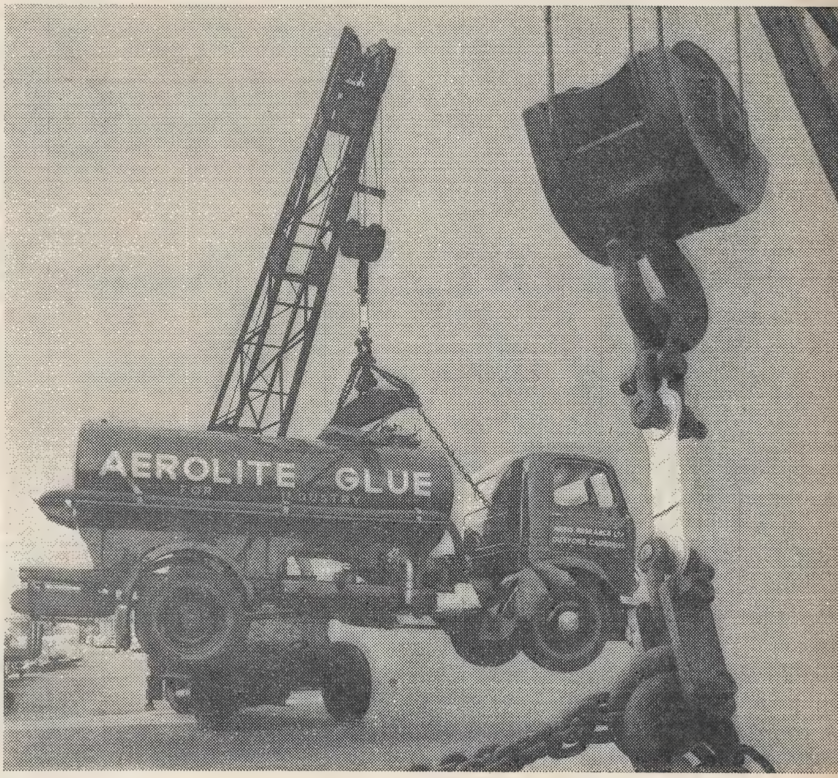
Plywood and other composite wood structures, including bentwood furniture, are usually fabricated by heat-pressure processes; the former, after application of the resin, being pressed between heated platens, and the latter in shaped dies with hand or mechanically-operated clamps. Impregnation of either solid or laminated timber with synthetic resins, by processes generally similar to those used in the preservation of timber with creosote, etc., produces an extremely strong material suitable for high-duty components such as airscrew blades; a well-known product of this type is

Jabroc, which is used extensively in aircraft construction.

One of the most remarkable developments in synthetic adhesives is the bonding of highly-stressed metal parts, such as the main components of aircraft. In the early days of aircraft development, the value of good quality natural glue was fully appreciated, but when wood was supplanted by metal the only methods at first considered practicable were riveting, bolting or welding, and these were highly satisfactory within certain limits of stress.

As the performance of aircraft was stepped up, however, it was found that the tendency to fatigue failure in their structures increased to such an extent that every possible means of improving them had to be investigated.

No matter how carefully the conventional metal joints are designed and made, destruction tests show that they often form a focal point for the beginning of a fatigue crack, which rapidly spreads like a breach in a dam until the joint fails altogether. The logical remedy for this is to devise a form of joint which does not involve either the drilling of holes or internal changes in the metal by local heating—and this has been made possible by the use of synthetic adhesives. Many types of aircraft components are now being fabricated by metal bonding methods and, having been subjected to the most exacting tests both in the air and the laboratory, have proved entirely satisfactory.



A light alloy testpiece with lap joints bonded by Araldite adhesive shown under test—and the test load, a 4½ ton tank lorry, which is well within the margin of safety of the joint

A considerable amount of research in adhesives for this purpose has been carried out by Aero Research Ltd, who have produced the Redux and Araldite adhesives specially for metal bonding, besides several other resin glues for plywood bonding and other industrial uses.

Some of these preparations are of the cold-setting type, which must be mixed with an accelerator or hardening agent immediately before use, but the hot-setting types, which enable production to be speeded up, are most commonly used in aircraft fabrication. These may be obtained in liquid form, by which process it is brushed or sprayed on the contact surfaces of the metal before fitting together—or in powder, which is dusted or sprinkled on the metal previously pre-heated to about 120 deg. C. Yet another form of the adhesive is in solid rods, which are rubbed on the heated metal. If the joints are thoroughly clean and closely fitted, application to one of the joint surfaces only is sufficient, but if conditions are in any doubt it is best to coat both surfaces.

Curing time for these adhesives will depend on the temperature, which must not be lower than 120 deg. C. or higher than 250 deg. C.; at 200 deg. C., about 40 minutes will effect complete hardening. The parts must be held together by light clamping pressure during the process. For large structures, such as a complete aircraft wing, a special electrically heated oven resembling a steriliser or autoclave is employed, but small parts can be dealt with in an enamelling stove or even the domestic gas oven.

The Araldite, Redux and Aerolite glues can be used for many other purposes besides aircraft—for instance, bonding of porcelain, glass, rubber, ivory and plastics. Successful repairs in metal castings, such as cracked waterjackets of car engines can be carried out by heating the metal sufficiently to enable Araldite powder or rod to be applied, and then maintaining the heat for a period long enough for complete curing.

Adhesive tapes

By no means the least important application of plastics, the use of adhesive tapes has vastly increased in recent years and is rapidly being adapted to new purposes in industry.

The original plastic adhesive tapes were mostly of cellulose acetate, coated with a non-drying rubber latex adhesive, and intended mainly for the purpose of securing small packages, mending books and similar domestic jobs. While these are still popular, improvements have been made both in the tape and the adhesive coating which have enabled their use to be greatly extended. Polythene and P.V.C. are now employed for purposes so widely varied as holding wigs in place, hermetic sealing of containers for food, tobacco and technical components, and grafting fruit trees.

For insulating electrical components or binding connections, these tapes have great advantages over textile or rubber tapes, being free from climatic deterioration or contact with oil or chemicals. The greater flexibility and elasticity of P.V.C. or polythene, compared with acetate, enables them to be neatly applied to bends, tee pieces or other irregular surfaces, and their high-frequency characteristics make them suitable for use in radio, television and radar instruments.

The Lasso range of tapes include Lassoband (cotton base), Lassothene (polythene), Lassovic (P.V.C.) and

PLASTICS . . .

Lassothyl (ethyl cellulose), besides several others for special purposes.

Identification tapes, with printed numbers, lettering or code symbols, are taking the place of tied or stuck-on labels for packaging and can also be used on instrument panels or machine controls. Further uses for tapes are for masking components during spray painting, blanking off pipe unions and other openings in machinery for transport, and the protection of finished machined parts such as shafts, both against corrosion and scratching or abrasion.

Foundry adhesives

Synthetic resins are now extensively used for bonding sand cores and moulds. Within the last few years an entirely new foundry technique has been evolved, in which the use of "flasks" or moulding boxes can largely be dispensed with, foundry floor space economised and rate of output increased; but even more important, a much higher accuracy and finish can be obtained on the castings.

FILLING, STOPPING AND SEALING COMPOSITIONS

In painting and other surface finishing processes, the older preparations for building up, closing pores and stopping cracks are being superseded by new compositions in which the bonding medium is synthetic resin. Some of these have metallic fillers, and not only adhere much more tenaciously to metal than any previously available, but are sufficiently hard when set to be filed or drilled and to resist wear or rough usage. Special preparations are also available for stopping blowholes and cracks in metal castings, and porosity can be cured by a special impregnating process in which the resin is forced into the pores under high pressure; these measures have been found effective even for castings subject to heavy duty or internal pressure—and enable parts which would otherwise have to be scrapped to be reclaimed.

Plastic sealing preparations for glazing, proofing of joints in car bodies and roofs and similar purposes, are extensively used in industry and are becoming more and more popular for domestic repairs and maintenance.

In conclusion

In this series of articles I have classified the many kinds of plastic materials and processes—to date—likely to be useful to the amateur engineer and the individual professional worker.

The suppliers of plastics mentioned are not the only ones in existence, nor is it suggested that those omitted are not genuine or reliable, but simply that first-hand experience of their products is not available.

I trust that my efforts in bringing the many possibilities of plastic materials to the notice of readers will assist them to explore this entirely new field of technique, which is not only capable of solving or simplifying many problems in workshop processes, but is sufficiently interesting to attract all who like to experiment with novel methods.

Manufacturers and suppliers

Vinagel Adhesive Paste: Vinyl Products Ltd, Carshalton, Surrey. **Casco (Casein) Glue:** Leicester, Lovell and Co. Ltd, Baddeley Works, Southampton. **Beetle and Scarab (Melamine) Adhesives:** British Industrial Plastics Ltd, Oldbury, Birmingham. **Cellobond Resin Adhesives and Foundry Resins:** British Resin Products Ltd, Devonshire House, Piccadilly, London, W.1. **Araldite Adhesives:** Aero Research Ltd, Duxford, Cambridge. **Bondafiller:** Bondaglass Ltd, 40a, Parsons Mead, West Croydon, Surrey. **Lasso Adhesive Tapes and Tissues:** Smith and Nephew Ltd, Welwyn Garden City, Herts. ▣

IS THIS ALBERT EDWARD?

By A. C. Wilkins

WHILE looking at some back numbers of MODEL ENGINEER I came across a review of C Hamilton Ellis' book *The Beauty of Old Trains*.

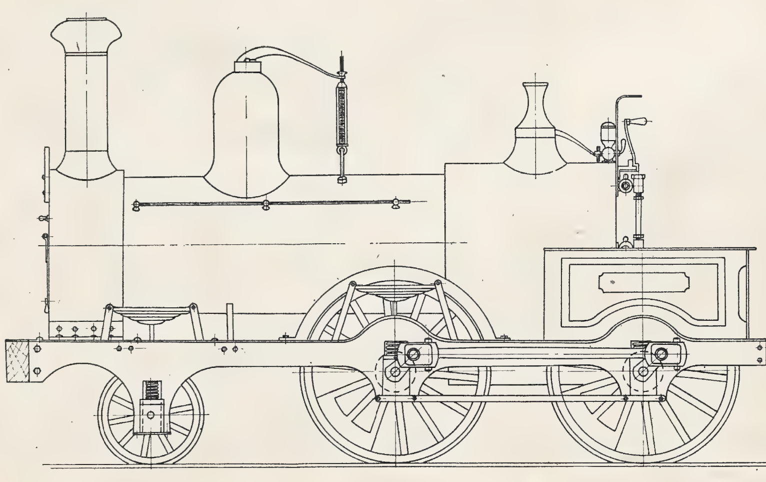
It contained a statement that the *Albert Edward* was originally a 2-2-2, subsequently altered to a 4-2-2.

I have in my possession a scale model of the loco in question. It was built by the late H. J. Wood, well known for his shop in Oxford Street, London. It has a gauge of 4¾ in., a 2-4-0 wheel arrangement, brass frames, wheels and boiler and it is fitted with Stephenson's link motion. Fred Smithies, of Smithies Boiler fame, told me that it represented a Midland engine of the 1870 period.

When in Derby I inquired at the locomotive works, but I was told that owing to war damage the plans and documents were destroyed. I visited the Derby museum and spoke to members of the local model engineering society but I could gain no further information.

I am beginning to wonder whether the engine I have is a replica of the *Albert Edward*. I have stripped it down and I need the information to rebuild it and to make a new tender as the original is missing. Perhaps, also, a reader would know the true wheel arrangement.

The drawing accompanying this article was made by my son a few years ago. ▣

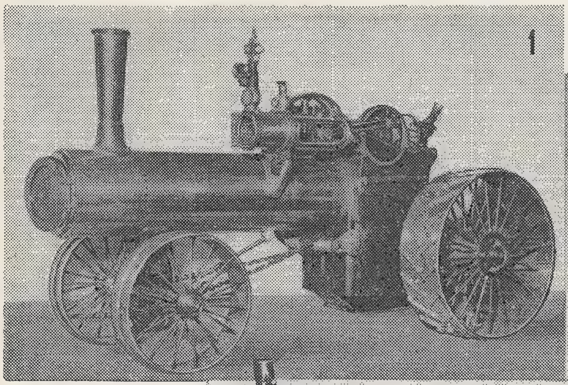


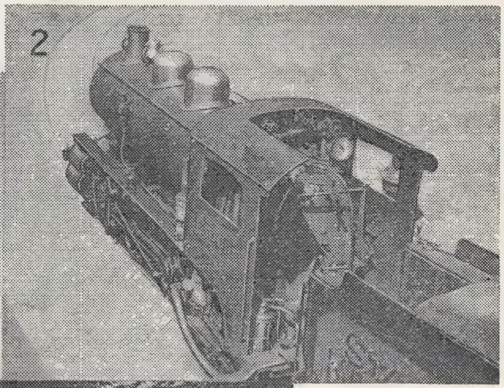
The Vancouver Exhibition

A page of pictures of the models associated with this British Columbia show

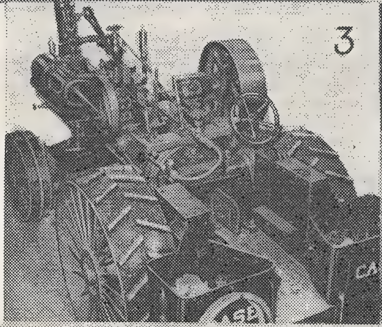
1: *A partly finished American-style traction engine*

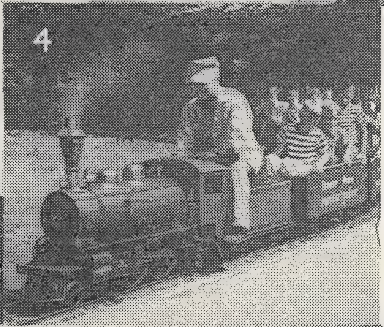
2: *An engine on the model railway at Stanley Park*



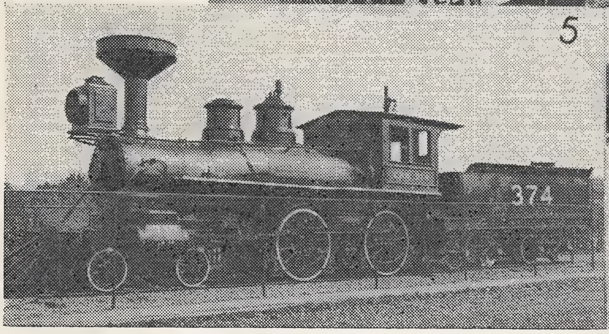


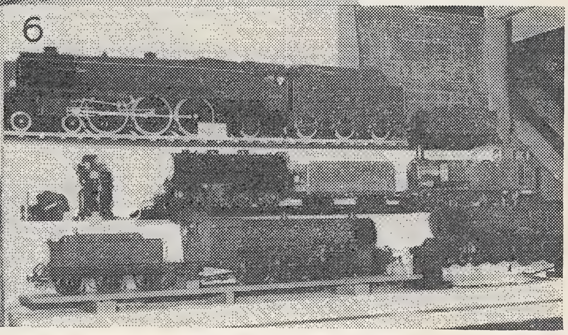
3: *A fine example of the American type of engine*





4: *A loco hauling a train full of enthusiasts at Stanley Park*



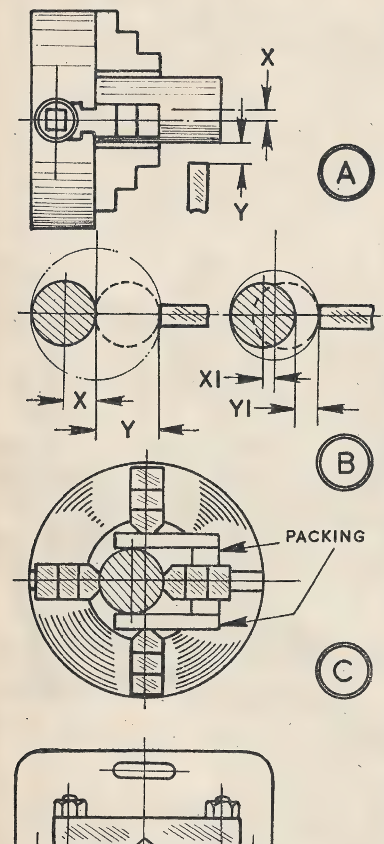


5: *Old Canadian Pacific engine in the park at Kitsilano Beach, Van.*

6: *The L.M.S. loco at the top is built entirely of wood; all the valve motion parts work*

Beginner's Workshop By GEOMETER

ECCENTRIC MOTIONS AND SET-UPS



MOTIONS employing eccentrics are common in applied mechanics and can be arranged in several ways.

First, in conjunction with a connecting rod, an eccentric gives straight-line motion to a spindle or plunger. Second, without any intermediary, an eccentric gives straight-line motion to a spring-loaded tappet in a guide. Third, using a pivoted lever, an eccentric gives circular motion to its free end through a small arc—and such a lever may be spring-loaded like the tappet for return, or this may be arranged by employing a connecting rod between the eccentric and the free end of the lever.

The first application is normal for operation of the slide valve of a steam engine, or the plunger of a feed pump; while the other two applications are normal for operating the petrol pumps of car engines.

Basically, eccentric motion is the same as that of a crank-connecting-rod system, with the difference, however, that for most practical purposes the mechanism is non-reversible.

This is to say that, while a crankshaft can be turned to operate a piston, or a piston pushed to turn a crankshaft, only an eccentric can be turned to operate a spindle or plunger. Neither can be pushed to turn the eccentric, owing to the friction involved in the disproportion of the considerable diameter to the small throw.

Setting up bar

Since an eccentric is circular, a loose one to fix on a shaft with a grubscrew can be machined in a straightforward manner in a lathe. A four-jaw independent chuck is employed to set up the round steel bar for the outside to be turned to size and the bearing surface machined. Then the whole bar is displaced eccentrically in the chuck for drilling and reaming the bore—or drilling and finishing with a boring tool.

The off-set of the bore (or throw) in relation to the outside diameter is normally obtained in one of two ways. With the bar held in the chuck, as at *A*, the off-set required is *X*, and is obtained by regulating the chuck jaws. Rotating chuck and bar, and bringing a flat-ended tool or pointer just to touch the high spot, then rotating a half-turn to find the low spot, a gap, *Y*, is left, and this is twice *X*.

Thus, *Y* can be measured with a small rule—or a piece of material of suitable thickness or diameter can be used as a gauge (a drill shank, for example).

This is true whatever the size or off-set, as at *B*. If the shaded bar is displaced so its side is on the chuck axis, the displacement is equal to the radius *X*, and when the chuck is rotated the gap is equal to the diameter *Y*. At a smaller off-set of the bar, *X*1 is half *Y*1.

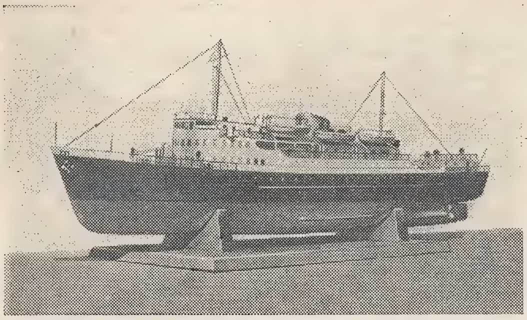
The second way of obtaining the off-set or throw is to mark the bar while laid in V-blocks, centre-punch the position, then bring this spinning true in the chuck.

If the off-set is kept in line with a pair of chuck jaws, the position of these on the chuck face serves as a guide in preliminary setting—the face may be ringed for reference, or a small rule may be used to check movement of the jaws.

For a considerable off-set, packing is advisable between two jaws and the bar, as at *C*, to avoid side thrust on the jaws and admit of proper adjustment. Strips of paper between the packing and surfaces, in conjunction with firm tightening, will avoid slip. Packing may also be used when fouling of jaws would otherwise occur.

A bar may be set up in a V-angle plate, *D*, for machining or boring eccentrically, the angle plate being mounted on the lathe faceplate and adjusted accordingly. Again, a single eccentric can be bored clamped to a flat plate, *E*, this held in a four-jaw chuck.

An eccentric mandrel, *F* (top), can be used for machining outsides after boring when several eccentrics are being made; and for facing ends, eccentrics can be pressed or held by a grubscrew on a simple mandrel (bottom). ■



A WORKING MODEL OF
ST NINIAN

By EDWARD BOWNESS

The correct positioning of the waterline is important—and in this second instalment special emphasis is placed on this point

(Continued from 3 January 1957, pages 3—6)

THE waterlines should now be drawn. The points through which they run are taken from the body plan Fig. 3 [see page 5, January 3 issue]. This drawing is included in the set which has been prepared for this series, and is available from the Percival Marshall plans service. It has been drawn the actual size of the model so that the sections can be traced or measured direct.

The builder who prefers to make his own body plan can do so quite easily. From the scale given draw vertical and horizontal lines to represent inches or half inches on the reproduction so as to form a grid. A similar grid, but with the inches the correct size, should be drawn on a separate sheet of paper. The sections may then be plotted in the way used in map-making, by noting where they intersect the lines of the grid.

In drawing the waterlines the work must be done systematically or confusion will arise. Each waterline should be treated separately. Take a piece of paper having a straight edge and place this edge on the particular waterline on the body plan (Fig. 3) with which you are dealing. Draw an arrowhead at the centre line and mark the intersection of each section line on this paper as shown in Fig. 4. Transfer these points to the respective perpendiculars ("stations" is the correct term) on the full-size hull drawing.

The portion of each waterline aft of the midship section (station 5) is taken from Fig. 3*A* and that forward of the midship section from Fig. 3*B*.

Then draw a smooth curve through the respective points. If the points do not give a smooth curve check the irregularities with the body plan and make the necessary corrections. It is important that the curves should be smooth. Repeat this process until all the waterlines are drawn. Note that W.L.h. fades out just aft of station 8½ where it joins the rail. The lines should be drawn firmly, using a fairly black lead pencil.

Before transferring the lines to the boards a centre line should be drawn along the lower side of each board and the position of the midship section (station 5) should be drawn at 90 deg. to it. Lay the hull drawing face downward on the board with the centre line and station 5 coinciding. With the same black lead pencil go over the waterline from end to end, using reasonable pressure. The waterline will thereby be transferred to the wood, and can be made stronger if necessary.

Now reverse the hull drawing on the board so that it is face upward, with its centre line and station 5 coinciding as before. Go over the waterline again carefully, thus transferring the other half of the waterline to the wood. Waterline *A* should be drawn on the lowest board, layer 1, waterline *B* on layer 2, waterline *C* on layer 3 and so on.

The boards should then be cut to their respective waterlines, taking

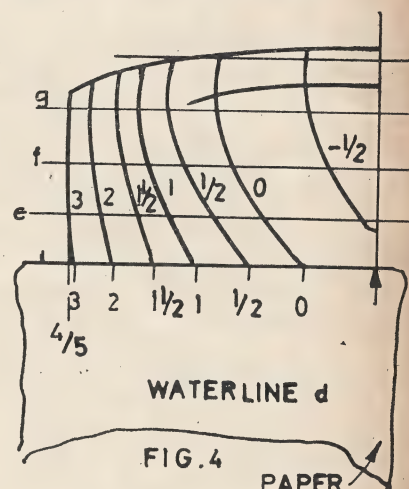


FIG.4

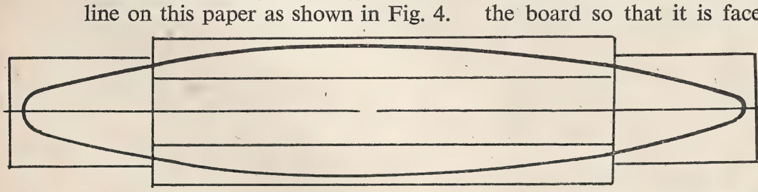


FIG.6

Top, right, Fig. 4: Method for obtaining the width at the waterlines

Left, Fig. 6: A suggested scheme for building the former and, Fig. 5, after half of the former as seen from below

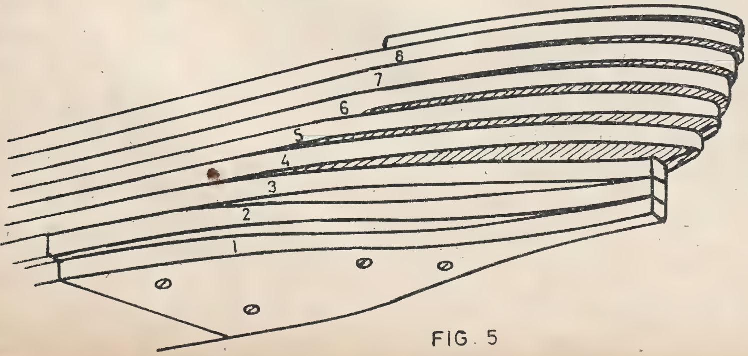


FIG. 5

Right, Fig. 7: Method of using the templates

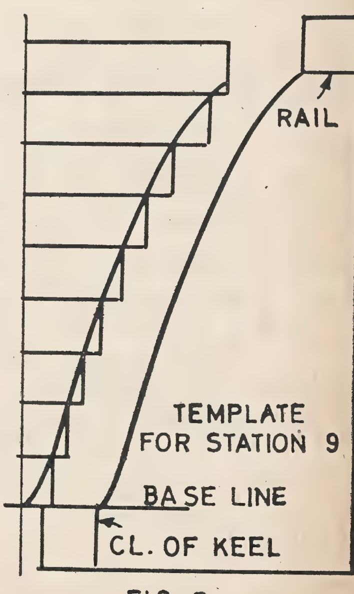
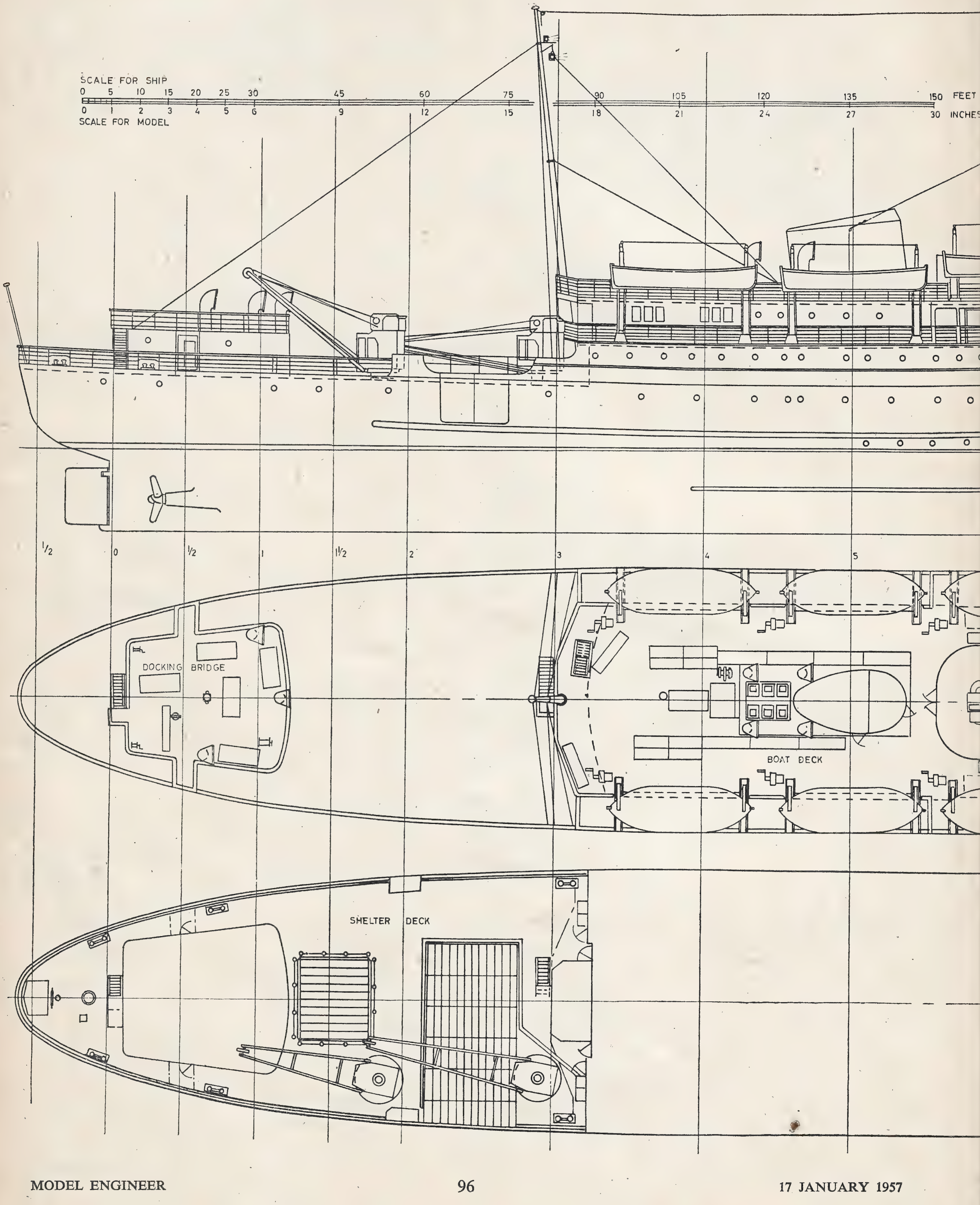
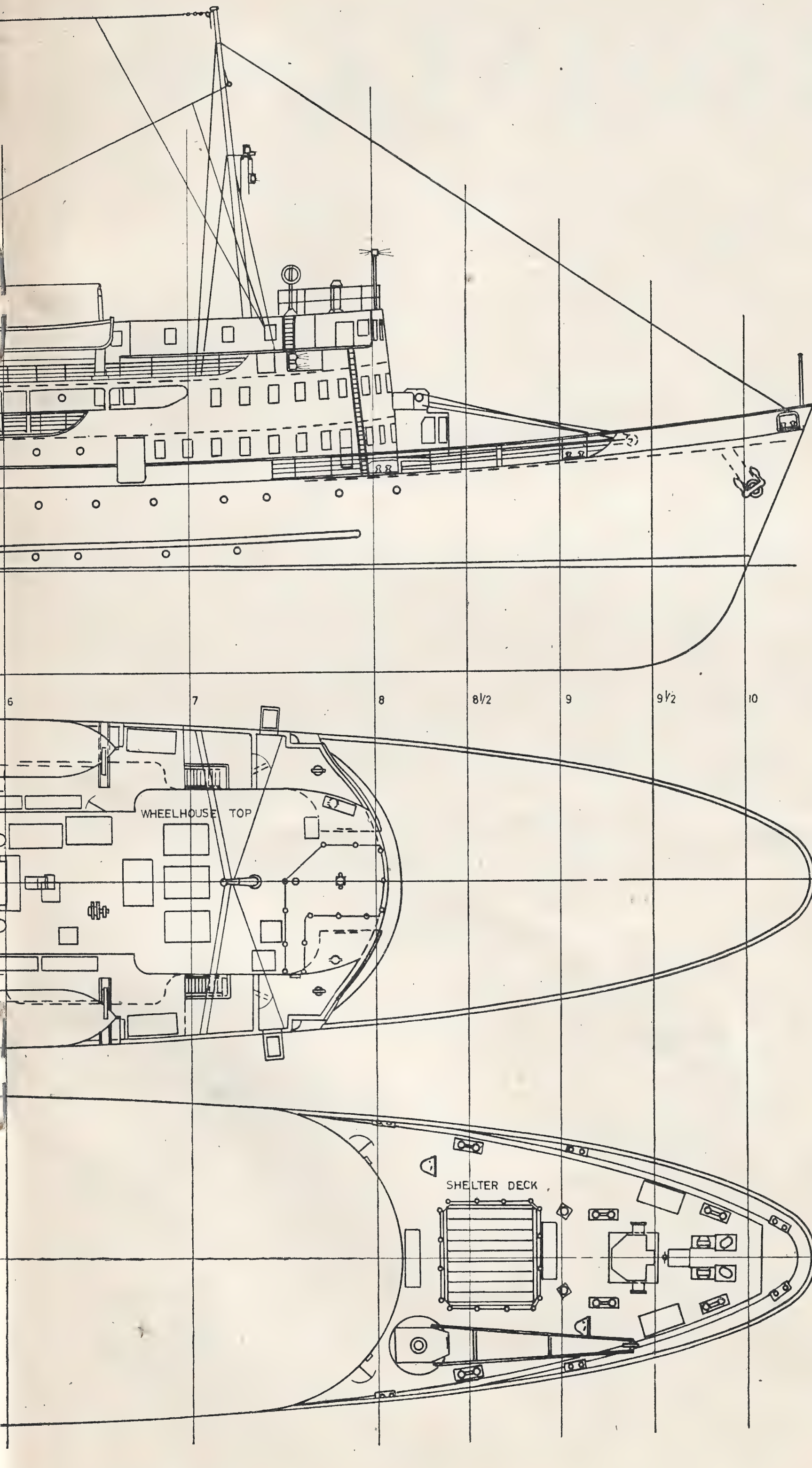


FIG. 7


SCALE FOR SHIP
0 5 10 15 20 25 30 45 60 75 90 105 120 135 150 FEET
0 1 2 3 4 5 6 9 12 15 18 21 24 27 30 INCHES
SCALE FOR MODEL
1/2 0 1/2 1 1 1/2 2 3 4 5
DOCKING BRIDGE
BOAT DECK
SHELTER DECK



great care to follow the lines accurately. The line indicating station 5 should be carried down on each side of the wood and the centre line over each end, to assist in locating the layers when assembling. When the boards are marked and cut out they should be screwed and glued together. Gluing is not necessary except perhaps at the thinner part of the former, such as the sternpost and the stem (see Fig. 5).

It will be realised that a considerable amount of the wood is wasted in building a solid former such as this, not only at the outer corners of the layers, but in the centre. To avoid this and to reduce the cost, the layers other than layer 1 could be built up of narrower pieces of wood—the only essential being that the wood should be wide enough to contain its own waterline and to have sufficient material within it to allow of its being glued to the layer next below (see Fig. 6). If this method is adopted it will be essential to glue the layers together, as screws would, in places, be too close to the lines and would interfere with the subsequent shaping of the former.

When the former is completely assembled the position of each of the stations should be indicated on the topmost board by lines drawn across and down the sides and on the bottom board by lines crossing the centre line. These are required for locating the templates when cutting the former to shape. The projecting corners of the layers (Fig. 7) should now be cut away, keeping the curves of the surface as smooth as possible. Templates can be made of any convenient material, such as stiff cardboard or thin plastic, shaped as shown in Fig. 7 and with the necessary markings on them for location during use. Each template should have its station number clearly indicated, the shape of the section being taken from the corresponding curve on the body plan, Figs 3*A* and 3*B*.

As the carving proceeds, the templates are applied to show where material must be removed, but when the angles between the layers are about to disappear be careful not to take things too far. The template should fit closely from the rail level to the centre line of the keel. The surfaces between the stations should fair in smoothly in a lengthwise direction whether the curves are concave or convex. The curvature can be checked by means of a thin batten.

The former should now be rubbed down reasonably smooth with sandpaper, using a flat block for convex surfaces and a rounded one for concave surfaces. Care must be taken not to lose the accuracy of the form.

● *To be continued.*

VIRGINIA

This week L.B.S.C. completes the description of the boiler fittings for the old-style $3\frac{1}{2}$ in. gauge American locomotive

Continued from 3 January 1957, pages 25 to 27

MANY of the old American engines had a sloping water-gauge at the opposite side of the backhead to the three try-cocks, and canted to a matching angle; but the reason—if any !—for this has disappeared along with the old Red Indian legends.

I prefer the straight-up kind and I have specified one for *Virginia*. It fits in nicely on the backhead between the throttle and injector steam-valve; and the large steam and waterways render it perfectly reliable. It is also easy to make and fit.

For the upper fitting, chuck a piece of $\frac{5}{16}$ in. rod in three-jaw, face, centre, and drill to $\frac{5}{8}$ in. depth with No 12 drill. Screw 5/32 in. of the outside with $\frac{5}{16}$ in. $\times$ 32 die in tailstock holder and part off at a full $\frac{1}{2}$ in. from the end. Reverse in the chuck, tap 7/32 in. $\times$ 40 for 5/32 in. depth, slightly countersink the end, and skim true. Drill a $\frac{3}{16}$ in. hole in the side, halfway down.

Chuck a bit of $\frac{3}{8}$ in. rod, face, centre, drill for a full $\frac{1}{2}$ in. depth with No 30 drill, turn down $\frac{3}{16}$ in. of the outside to $\frac{1}{4}$ in. dia. and screw $\frac{1}{4}$ in. $\times$ 40. Part off at $\frac{1}{2}$ in. from the end, reverse and hold in a tapped bush, turn the outside to contour shown, and turn $\frac{1}{16}$ in. of the end to a tight fit in the hole in the body part. Squeeze it in and silver solder it. The plug is turned up from a bit of $\frac{5}{16}$ in. rod and needs no detailing. The top is filed square.

Bottom fitting

The bottom fitting is turned from $\frac{3}{8}$ in. rod. Chuck in the three-jaw, face, centre, and drill to $\frac{3}{4}$ in. depth with No 30 drill. Turn down $\frac{3}{16}$ in. length to $\frac{1}{4}$ in. dia. and screw $\frac{1}{4}$ in. $\times$ 40, parting off at 1 in. from the shoulder. Reverse and rechuck in a tapped bush. Turn down the outside to a full $\frac{5}{16}$ in. dia. to within 3/32 in. of the shoulder. Centre and drill No 43 until the drill breaks into the No 30 hole. Open out and bottom to $\frac{3}{8}$ in. depth with 7/32 in. drill and D-bit, tap the end $\frac{1}{4}$ in. $\times$ 40, and slightly countersink.

At $\frac{1}{4}$ in. from the end drill a 5/32 in. hole into the recess just formed and in it fit a 7/32 in. $\times$ 40 union nipple. At $\frac{3}{8}$ in. from the shoulder at the other end, and diametrically opposite, drill a $\frac{3}{16}$ in. hole and in that one fit a $\frac{5}{16}$ in. $\times$ 32 nipple made like a union nipple but counter-bored with No 12 drill to $\frac{1}{8}$ in. depth. Silver solder both.

Chuck a piece of $\frac{5}{16}$ in. hexagon rod, face off, turn down 5/32 in. length to $\frac{1}{4}$ in. dia. and screw $\frac{1}{4}$ in. $\times$ 40. Part off at $\frac{1}{4}$ in. from the shoulder, rechuck in the tapped bush, turn outside to shape shown, centre, drill through with No 30 drill, open to $\frac{1}{8}$ in. depth with No 21 drill, and tap the remains of the hole 5/32 in. $\times$ 32.

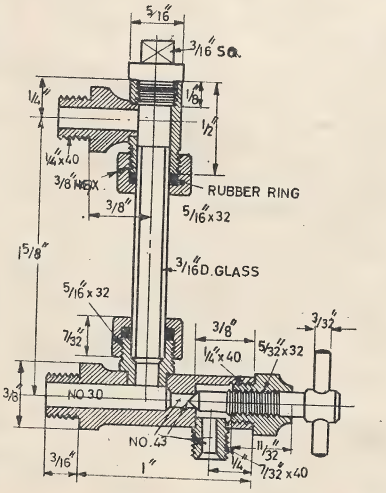
For the pin, chuck a piece of $\frac{3}{16}$ in. rustless steel or bronze rod, turn down $\frac{3}{4}$ in. length to 5/32 in. dia. and screw $\frac{5}{8}$ in. of it with 5/32 in. $\times$ 32 die. Turn off the thread for $\frac{1}{4}$ in. from the end and turn a blunt cone point (about 90 deg. angle) on the end.

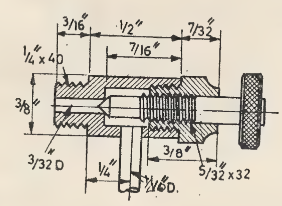
Part off at a full $\frac{3}{16}$ in. from the end of the 5/32 in. section, slightly chamfer the end, drill a No 43 cross-hole through it and squeeze in a piece of 3/32 in. steel to form the handle. Round off the ends as shown. The two gland nuts are made from $\frac{3}{8}$ in. hexagon rod and are the same as union nuts, but only 7/32 in. long so as to leave as much of the glass showing as possible.

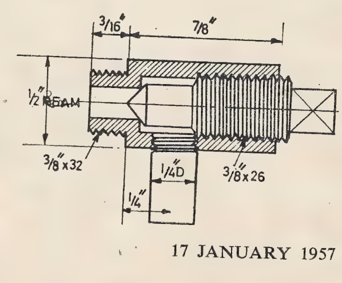
To fit the gauge to the backhead scribe a vertical line on the backhead at $\frac{7}{8}$ in. to the left of the centre line. On this, at $\frac{3}{16}$ in. from the edge of the backhead, make a deep centre-pop; and another at $1\frac{5}{8}$ in. below it. Drill these 7/32 in. and tap $\frac{1}{4}$ in. $\times$ 40. Screw in the top and bottom fittings of the gauge with a smear of plumbers' jointing on the threads.

To get them exactly in line, put the shank end of the No 12 drill through the top one and adjust them until it will drop into the counterbore of the bottom one. If they don't come right within a quarter-turn when tightened up, a little gentle coaxing may do the trick, as soft copper will "stretch," but be careful to avoid overdoing it and stripping

Details of the water-gauge, water-level test valve and the boiler blowdown valve





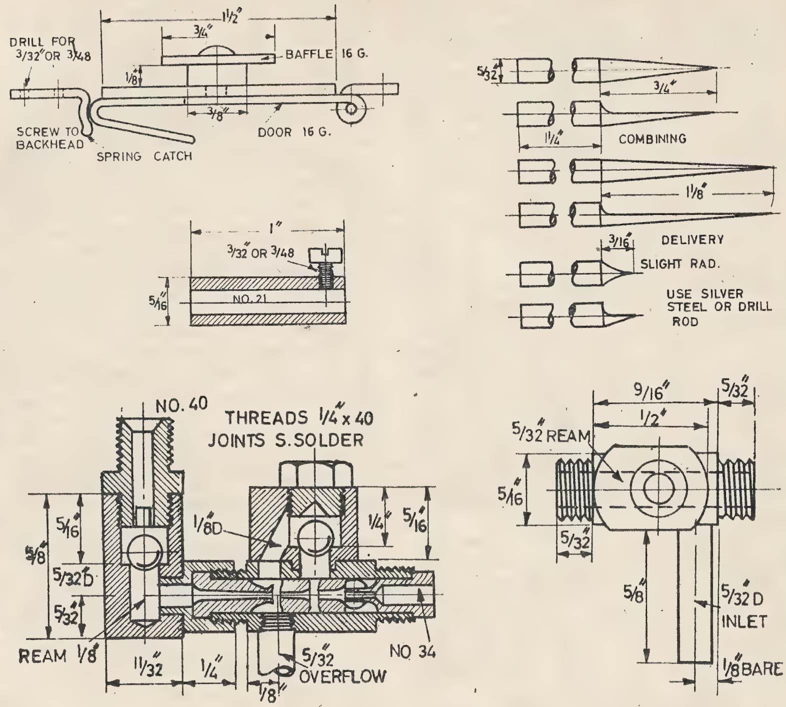


the threads. My own pet trick is to use one or more thin copper washers punched out of a bit of foil between flange and backhead.

Cut a piece of $\frac{3}{16}$ in. glass tube $1\frac{1}{4}$ in. long; nick with a three-cornered file and break it with your fingers. To make rubber packing washers slide a short length of $\frac{1}{4}$ in. rubber tube with a $\frac{3}{16}$ in. bore on to a piece of $\frac{3}{16}$ in. rod, hold in chuck, run the lathe fast and apply a wet discarded safety-razor blade at 3/32 in. intervals. When the rubber tube is pushed off the rod it will fall into rings.

Put the wetted glass tube down the top fitting, slide a wet ring on to it, then put the two gland nuts on, back to back, then another ring. Let the glass drop into the counterbore in the bottom fitting, push down the gland nut—it will take the packing-ring with it—and screw it finger-tight. Push the other one up against the top fitting and screw that finger-tight also; then give each another half-turn with a spanner.

The glass should be free to expand so the nuts should be just tight enough to prevent leakage, *and no more*. Screw in the top cap and the job is done.



Dimensions of the firehole door, reamer stop, reamers for injector cones and the injector

WATER-LEVEL TEST VALVE

Chuck a piece of $\frac{3}{8}$ in. round rod, face, centre, and drill to $\frac{7}{8}$ in. depth with 3/32 in. or No 43 drill. Open out and bottom to $\frac{7}{16}$ in. depth with 7/32 in. drill and D-bit and tap the end $\frac{1}{4}$ in. × 40. Part off at a full $\frac{11}{16}$ in. from the end, reverse in the chuck, turn down $\frac{3}{16}$ in. of the other end to $\frac{1}{4}$ in. dia. and screw $\frac{1}{4}$ in. × 40.

At $\frac{1}{4}$ in. from the shoulder drill a No 32 hole and silver solder a short piece of $\frac{1}{8}$ in. thin-walled tube into it. The cap and pin are made exactly the same as those at the bottom of the water-gauge but a little hand-wheel may be fitted, like that on the injector steam valve. At $\frac{7}{8}$ in. to the right of the backhead centre line and $1\frac{1}{8}$ in. from the top drill a 7/32 in. hole, tap $\frac{1}{4}$ in. × 40 and screw in the valve with the pipe hanging down.

The boiler blowdown valve is merely a glorified edition of the above, made by the same process, to the dimensions shown on the drawing. The $\frac{1}{4}$ in. blowdown pipe may be screwed in if desired. The end of the plug is squared so that the valve can be operated with a box-spanner from the back of the engine, out of the way of boiling water which comes out with considerable force when the boiler is blown down with about 20 lb. pressure left in it. This usually removes scale and sludge after long periods of running and saves much washing-out when hard water is used.

Practically all the old tea-kettles had the swing firehole door. Castings will probably be available for *Virginia* and, if so, will only need drilling and fitting with hinge-lug and handle. Otherwise, cut the door and baffle from 16-gauge sheet steel and turn the distance-piece from a bit of $\frac{3}{8}$ in. round steel, making the pips 3/32 in. dia. and 3/32 in. long. Drill the holes in door and baffle with No 41 drill and assemble as shown.

The hinge straps and handle can be cut from strips of 18-gauge steel and riveted on with bits of domestic pins, the ends being bent to a circle to accommodate the $\frac{1}{16}$ in. hinge-pin. The hinge lug is also cut from 18-gauge steel, with a bent end for the pin. Drill three No 40 holes in the door, as shown in the cab view, to let a little air in over the fire when smoky coal is used, otherwise the engineer will need a gas mask.

I usually make my spring catches from the strip bronze used for holding down electric-motor brushes; this is just the stuff for the job, being nice and springy. Alternatively, thin hard brass strip can be used or the thin steel used for gramophone governor springs. Both the spring catch and the hinge lug are attached to the backhead with home-made screws turned up from $\frac{3}{16}$ in. bronze and threaded 3/32 in. or 3/48. Commercial "brass" screws usually rot away and break off when used in boiler work due to electrolytic action set up by the zinc in the alloy used.

INJECTOR

The injector is one of my "standard" types, the dimensions of which were obtained after much experimenting, and is similar to that specified for *Ivy Hall*, but the water inlet is at the side and the overflow pipe is curved and long enough to reach to the side of the engine as the injector is located centrally and close to the drag beam.

The first job is to make the cone reamers, which are turned from 5/32 in. silver steel or drill rod. Chuck in the three-jaw and turn the tapers very carefully to the length shown. For the very short one turn a straight taper for $\frac{3}{16}$ in. then very slightly radius it with a half-round file while the job is running in the lathe. File away half the diameter of the taper, then harden and temper as described for pin-drills and other items.

When running the munition shop in the latter part of the Kaiser's war I did a lot of the toolmaking myself—had to, as really skilled toolmakers were scarce—and made lots of little reamers. I used to harden and temper at one operation by using a small pail with water in it, on top of which I

poured a layer of sperm oil. The reamers were made bright red and plunged vertically through the sperm oil into the water. They neither distorted nor cracked and kept their edges very well. Rub the flats on an oilstone after tempering.

The stop is simply a brass bush with a setscrew in it. When placed on the reamer shank at the right spot it prevents the tapered part going too far into the cone and enlarging the throat above the correct drill size.

For the injector body, saw or part off a piece of $\frac{5}{16}$ in. square brass rod a full $\frac{7}{8}$ in. long. Chuck truly in the four-jaw, face, centre, drill through with No 23 drill and ream 5/32 in. Turn down 5/32 in. length to $\frac{1}{4}$ in. dia. and screw $\frac{1}{4}$ in. × 40. Reverse in the chuck and turn and screw the other end to same size, leaving distance between shoulders $\frac{9}{16}$ in.

In the middle of one of the facets drill a $\frac{1}{8}$ in. hole and pin-drill it to $\frac{1}{16}$ in. depth with a $\frac{3}{16}$ in. pin-drill. At $\frac{3}{16}$ in. away drill another $\frac{1}{8}$ in. hole clean through the body, and where the drill comes out tap it 5/32 in. × 40. At $\frac{1}{8}$ in. from the shoulder at the opposite end drill a No 23 hole on the side shown in plan and fit a $\frac{5}{8}$ in. length of 5/32 in. copper tube into it. This will be the water inlet.

Chuck a piece of $\frac{1}{2}$ in. round brass rod in the three-jaw, face the end and part off $\frac{3}{8}$ in. length. At $\frac{1}{16}$ in. from the centre indicated by tool marks make a centrepop and chuck in the four-jaw with this running truly. Drill through with No 34 drill, open out and bottom to $\frac{1}{4}$ in. depth with 7/32 in. drill and D-bit, and tap $\frac{1}{4}$ in. × 40. Run a $\frac{1}{8}$ in. parallel reamer through the remains of the 34 hole.

Chuck any odd bit of brass rod, turn $\frac{1}{8}$ in. length to $\frac{1}{4}$ in. dia., screwing $\frac{1}{4}$ in. × 40, and screw the $\frac{1}{2}$ in. piece on to it, then turn down $\frac{1}{16}$ in. length to a tight fit in the pin-drilled recess on the body. At $\frac{3}{16}$ in. from the reamed hole, in the wider part, drill a $\frac{1}{8}$ in. hole on the slant, breaking into the tapped hole as shown.

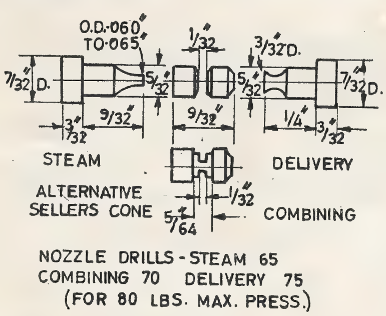
Fit the projection into the pin-drilled recess with the holes lining up as shown, then silver solder the joint and the side pipe at the same heating. Pickle, wash, and clean up, then poke the 5/32 in. reamer through again to remove any burring. Fit a ball and cap, as described for top of check valves, and file or mill a flat each side.

The combining cone must be a press fit and the easiest way to ensure this is to take a scrape out of the end of the reamed hole through the body, water-pipe end, with a taper broach. I keep a few taper broaches mounted in file handles in the tool-rack at the back of my bench and find them mighty handy.

Chuck a piece of $\frac{3}{16}$ in. rod and turn down $\frac{1}{2}$ in. of it until it will just enter the broached end tightly. Face, centre, and drill to $\frac{5}{16}$ in. depth with No 72 drill. Cut back the end very slightly to leave a blunt nose and part off at 9/32 in. from the end. Reverse in the chuck and ream the hole with the $\frac{3}{4}$ in. tapered reamer until the point just shows through; if the stop is put on the reamer at $\frac{5}{16}$ in. from the point, you won't "overshoot the platform."

With 5/32 in. of the cone projecting from the chuck jaws, saw it in two, using a very fine saw kept pressed against the jaws; then pull the "left-in" piece out a little way, skim off the saw marks, bevel it a shade and slightly radius the hole with the short reamer. Chuck the other half, skim off and bevel that likewise, and slightly radius the large end.

If the slotted cone is preferred, the Sellers type being true American, cut a groove 5/64 in. wide and $\frac{1}{16}$ in. deep with a parting-tool. Take care that the weeny cone doesn't fly out of the jaws while this is being done. Cut two 1/32 in. slots across the bottom of the groove with a watchmaker's flat file. This cone can be pressed straight in; the groove should come right under the hole at the bottom of the ball chamber.



The injector cones

To fit the divided cone, press in the nozzle half first, using the vice-jaws, with pieces of soft copper sheet over them as a press, to prevent damage to the injector body and cone. Use a piece of $\frac{1}{8}$ in. brass rod as a pusher, between vice-jaw and end of cone, and press in until the piece of cone is just past the middle of the hole at bottom of ball chamber. Then press in the other half likewise; and to prevent it going in too far put a sliver of brass 1/32 in. thick down the hole in the ball chamber and press in until the second half of the cone just touches it. Now poke the $\frac{3}{4}$ in. taper reamer into the cone and turn it gently with a tapwrench on the shank until a No 70 drill can just be pushed through.

For delivery cone, chuck a piece of 7/32 in. rod, face, centre, and drill No 76 to the depth of the drill flutes. Hold the drill in a pin chuck in the tailstock chuck and keep withdrawing the drill every $\frac{1}{16}$ in. or so to clear chips. Turn $\frac{1}{4}$ in. length to a tight push fit in the injector body, then shape the end as shown and countersink it with the short reamer.

Part off at 3/32 in. from the shoulder, reverse in chuck, centre, drill No 60 until you meet the first hole then ream with the $1\frac{1}{8}$ in. taper reamer until a No 75 drill can just be pushed through the throat. Countersink the end with the short reamer and skim true. The steam cone is made by same process, drilling No 66.

After turning nozzle to size and shape given, put the $\frac{3}{4}$ in. taper reamer down it until the hole is opened out almost to a knife edge. Reverse in chuck, centre and drill No 34 to 7/32 in. depth then put a No 65 drill through the remainder of the 66 hole. When the cones are pushed into place the steam cone should enter the combining cone 1/32 in. and the bell-mouth of the delivery cone should be almost flush with the nose of the combining cone.

THE CHECK VALVE

To make the check valve, chuck a piece of $\frac{3}{8}$ in. rod and turn $\frac{3}{4}$ in. length to 11/32 in. dia. Face, centre, drill to $\frac{9}{16}$ in. depth with No 34 drill, open out and bottom to $\frac{5}{16}$ in. depth with 7/32 in. drill and D-bit and tap $\frac{1}{4}$ in. × 40. At 5/32 in. from bottom, drill a $\frac{3}{16}$ in. hole breaking into the centre hole. Chuck a piece of $\frac{5}{16}$ in. rod, face, centre, drill No 30 for $\frac{3}{8}$ in. depth, open out and bottom to a full $\frac{3}{16}$ in. depth with 7/32 in. drill and D-bit, and tap $\frac{1}{4}$ in. × 40.

Part off at 11/32 in. from the end, reverse in chuck and turn down 3/32 in. length to a tight fit in the $\frac{3}{16}$ in. hole in the valve body. Press it in and silver solder it. Pickle, wash and clean up, then put a $\frac{1}{8}$ in. parallel reamer down the remains of the 34 hole. Seat a 5/32 in. rustless ball on it and fit a union cap.

Chuck a piece of $\frac{5}{16}$ in. hexagon rod, face, centre deeply, drill No 40 for $\frac{3}{8}$ in. depth, turn down $\frac{1}{4}$ in. length to $\frac{1}{4}$ in. dia. and screw $\frac{1}{4}$ in. × 40. Part off at $\frac{1}{2}$ in. from the end, reverse in chuck, turn down and screw the other end likewise for 5/32 in. depth, and cross-nick with a thin flat file. Assemble as shown.

If the valve doesn't line up with the injector when screwed right home take a slight skim off the flange of the delivery cone. The overflow pipe can be fitted when erecting.

● *To be continued.*

The *Wildcat railway*

By Joseph Martin

FOR FIFTY YEARS and eight months William Jones worked for the South Pacific Railroad in California. Now, in retirement, he works harder than ever.

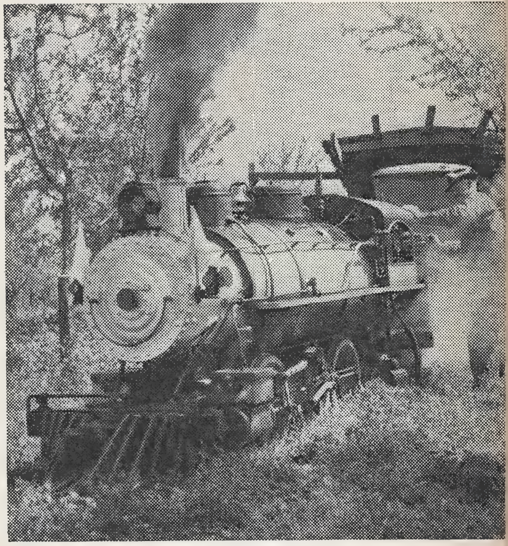
After driving a passenger train on the San Francisco-Santa Barbara run Mr Jones occupies himself with a line of his own—the Wildcat Railroad at Los Gatos (which means The Cats). The Wildcat has existed for 14 years and is, like president Jones himself, very well known among the live steamers of California.

Not surprisingly, Mr Jones wanted to see some of the British railroads, large and small, when he crossed the Atlantic recently in the S.S. *United States* for a five weeks' visit to the Old World. On arriving in London he called at the office of MODEL ENGINEER (where we were delighted to meet him) before leaving for Switzerland and Italy, both of which countries, Switzerland in particular, are rich in interest for the live steam enthusiast. "One railroad that I mustn't miss in England," he said, "is the Romney, Hythe and Dymchurch. Oh, yes, I know all about it!"

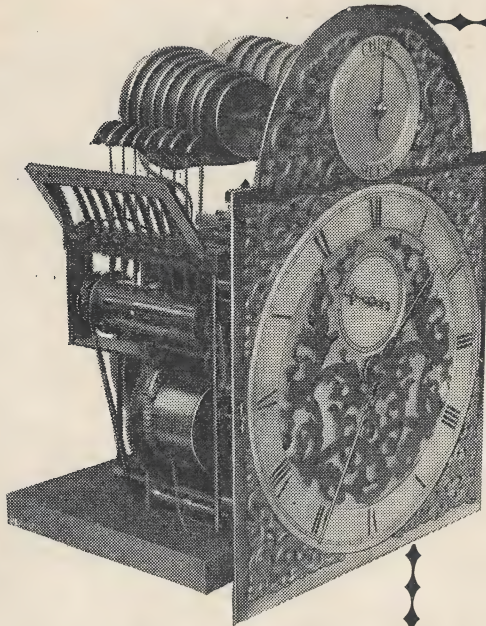
Far older than the railroad itself are the locomotives which operate on it. The smallest of them, the immensely popular four-ton *Billy Jones*, was built in 1905 at the Johnson Train Works in Los Angeles. This 18 in. gauger will draw 90 children at a time, or 16 adults in each of three cars. The other five are very large indeed—an eight-tonner and four 12-tonners, all built to 19 in. gauge. Fuelled by oil, they run on 1,940 ft of 20 lb. rail. Westinghouse air brakes contribute to the passengers' safety on a system which is formidably powered.

"I let the railroad be used by those who want to make money for a good cause," said Mr Jones. "There are no tickets. People give what they wish or ride for nothing—and that's O.K."

Mr Jones was full of sunny Californian vigour and we found it hard to believe that he had put in more than half a century's hard work before beginning a busy retirement as president of the Wildcat. We very much hope that he will come back on another visit, long enough for him to make a more leisurely tour of Old England and her railroads; and meanwhile he takes with him the cordial New Year greetings of MODEL ENGINEER to all the live steamers of California—including, of course, the enthusiastic Walt Disney who enjoys a trip on the Wildat at Los Gatos. ▣



The BILLY JONES *(see pictures) is a* 2-6-2 *engine with a working pressure of* 125 *p.s.i. Wheels are* 20 *in. dia., cylinders* 5 *in* × 7 *in. It weighs* 4 *tons. Westinghouse air brakes are fitted throughout. Below, left to right: D. Jones, W. Kimball, Walt Disney, B. Jones, Mrs Jones and Eddie Sargeant*



The M.E. MUSICAL CLOCK - 9

By C. B. Reeve

The plate and hammer springs and the musical hammers are among the items discussed this week

Continued from 3 January 1957, pages 7—10

THE back view of the plate with the hammer springs is shown in Fig. 25, Nos 3 and 3a. The plate or frame consists of brass of $\frac{1}{8}$ in. thickness $\times$ about $\frac{7}{16}$ in. in width. I mitred the brass strip at the corners and afterwards silver soldered the joints. If preferred, it can be cut out of a large piece of $\frac{1}{8}$ in. thick brass plate.

The frame should be filed up and finished, and when it is ready to be attached to the back of the hammer block—the sides of the frame are partially cut through and bent at an angle as shown in 3a—it can be cut through with a file; and after closing the joint it should be either soft soldered or hard soldered.

The brass springs for the hammers are made from a piece of shim brass which should be carefully flattened. This can easily be done by laying it on a flat surface and stroking the curved surface with the edge of a flat ruler. After marking out the dimensions it should be cut with a very fine fret-saw blade.

The free ends of the spring should not be cut through until all the sides have first been cut. Shim brass of 15 thou is a suitable thickness for the springs. Fig. 25, No 3a shows how the springs are fixed to the frame. It will be seen that they are sandwiched between the top member of the frame and a $\frac{1}{16}$ in. thick brass strip secured with No 10 B.A. screws put through the strip and the shim and screwed into the thickness of the top member of the frame. The frame is then fixed to the back of the brass block with two No 3 B.A. screws. Care must be taken in placing these screws so that they do not foul the retaining pin of the hammers.

The hammer springs should be bent so that the free ends make pressure on the back of the hammers at a point only just above the centre line of the hammer-retaining pin. It should be emphasised that an absolute minimum spring pressure is all that is required otherwise the available driving power of the weight will be insufficient for the pins in the chime barrel to fully lift the hammers.

POSITIONING THE HAMMER FRAME

Referring to Fig. 23 it will be seen that a right-angled section has been cut away from the top and sides of both movement plates. This section is the same length as the width of the block, but its height is a trifle longer than that of the block. The position of the hammer frame should be so arranged that the ends of the tails of the hammers are in line with the pivot centres of the chime arbor—or preferably slightly past the centres, but not before centres as it seems to appear in the drawing.

The hammer tails should just be clear of the surface of the chime barrel. This can be arranged when cutting the section in the movement plates. It will be found easier to finish filing both sections with the frame assembled.

The hammer frame or rack should now be fitted and screwed to the movement frame. It is held to the latter by two No 8 B.A. screws passing right through the thickness of the block into the thickness of the movement plates. A good way to obtain the position for drilling the holes for the screws is to hold or clamp the frame in position on the movement frame and then, with a fine steel point, scribe very carefully on the under side of the block the position of the edges of the plates of the movement frame.

Now find the centre distance between the scribed lines and at a suitable spot (about midway of the width of the block) centre pop a small dot, then drill the hole from the under side of the block. Next reassemble the block on the movement frame. Using the scribed lines as a guide, insert a drill in the hole upside down, and a light tap on the cutting end of the drill with the wooden handle of the hammer will produce a centre pop for drilling the hole in the plates.

It is very important that the hole be dead central with the thickness of the plates as the diameter of a No 8 B.A. fixing screw will occupy most of the thickness of the plate. It is awkward to drill these holes in the drilling machine owing to the height of the plates. The only alternative is to do the drilling with a hand drill ; if a very short drill is used it can be accomplished quite successfully. Two long No 8 B.A. screws will have to be made—and just a short length of thread on each screw is all that is needed.

Care must be taken—when the chime arbor is in position in the frame—that the shoulder of the front pivot is against the inside front movement plate, and that the last-chime hammer does not foul the side of the disc at the end of the chime barrel. A reference again to Fig. 25 will show what is required.

The left-hand end of the hammer block is cut to such a length that the upper arm of the large cock that holds the back pivot of the chime arbor just meets the end of the hammer block to which it is held by a No 8 B.A. screw. This same screw holds a thin steel spring, the lower end of which is always in contact with the end of the pivot of the chime arbor and keeps this item always pumped towards the front movement plate. This spring is shown in position in Fig. 25 and No 4 shows the face view of it.

The hour hammer shown at the extreme left-hand end of the block is made a little heavier than the chime hammers. Its tail is also longer. The exact length is better obtained by trial after the five lifting pins have been inserted in the striking barrel. It must be remembered that when the striking barrel is at rest the tail of the hour hammer will be midway between two adjacent lifting pins. Fig. 25, No 5 shows the back view of the steel portion of the hour striking hammer that works in the block. Fig. 26 shows the plan view of the hour hammer from above and Fig. 29 shows another view of the hammer and its relative position with the large bell.

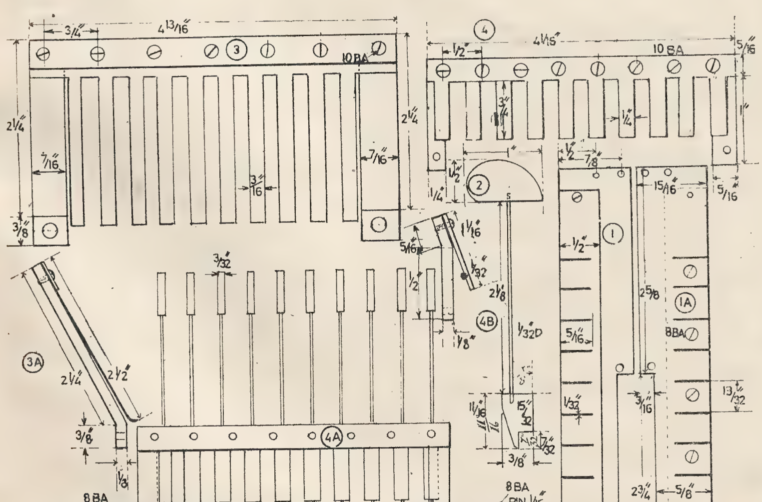
This bell, which is about 5 in. in diameter, is held by a standard screwed to the back-movement plate. This standard is built up from angle brass and its stem is silver soldered into the angle brass; and a knurled nut holds the bell in position on the upper end of the standard. It is made in a similar way to the bell standards used always in French clocks. It should be screwed and steady pinned to the back movement plate, using a No 0 B.A. screw with a large head. Such a screw has to be made.

THE MUSICAL HAMMER FRAME

The hammer frame is constructed on rather different lines from that of the chiming hammer frame. First, there is a brass baseplate 3/32 in. in thickness and approximately $5\frac{5}{8}$ in. in total length. This is shown in Fig. 33. No 1 shows the baseplate from above with the block proper in position. No 1a shows the plan view from below. It will be noticed that a section of slightly more than half the length of the baseplate has been cut away.

The block proper consists of a length of brass $\frac{1}{2}$ in. in width by $5\frac{5}{8}$ in. in length, its height being $\frac{1}{4}$ in. It is screwed with No 8 B.A. c.s. screws in the extreme ends to the base, and four similar screws are screwed from the under side of the baseplate into the block proper. Previous to screwing these two items together, a groove $\frac{1}{16}$ in. sq. is milled from end to end in the under side of the block proper. This groove is to accommodate the retaining pin for the 10 hammers and the slots for these should next be cut, their distance apart being approximately 13/32 in. They are cut $\frac{5}{16}$ in. deep × 1/32 in. in width and are produced in a similar way to the slots in the chime-hammer frame.

Fig. 33: Details of the musical hammer frame and springs



THE 10 MUSICAL HAMMERS

Fig. 33, No 2 represents the musical hammers. They are similar to the chime-quarter hammers. The flat portions that work in the slots are cut from 1/32 in. thickness steel plate. The hammer stems are about 1/32 in. in diameter and are not threaded and tapped into the flat steel portion of the hammer; but a small slot is filed in the latter to just fit the diameter of the stems which are then silver soldered in position, afterwards being smoothed off.

The hammer heads are the same size as the chime-quarter hammer heads, but only 3/32 in. in thickness. They can either be drilled and tapped to screw on the stems or drilled and soft soldered to the stems.

The construction of the plate and hammer springs is similar to its chime contemporary, only the dimensions being different. Fig. 33, Nos 3 and 3a shows all the details that are required.

THE BUFFER SPRINGS

Instead of having a fixed stop for the hammers to butt against, a set of 10 buffer springs or flexible stops is provided for the hammers. The frame for this component is shown in Fig. 33, Nos 4, 4a and 4b. The actual springs are cut out of one piece of brass plate 1/32 in. in thickness, which is screwed to the plate in a similar way to the springs on the other plate. From the drawing it will be seen that it is screwed to the front of the hammer block with two No 6 B.A. screws. Care must be taken not to run the screws into the sides of the slots.

The complete hammer frame should now be mounted on the movement frame. In this case no cutting of the plates is necessary, Figs 30, 31, 32

CLOCK . . .

and 34 show the hammer frame mounted in position on the movement plates. The hammer tails should be in the line with the pivot centres of the musical barrel, and the tips of the tails should just clear the surface of the musical barrel.

Two No 8 B.A. screws are used for fixing this fitment to the front movement plate and one No 8 B.A. screw is used for fixing it to the back movement plate. It is further secured by another No 8 B.A. screw put through the large musical-barrel cock into the end of the hammer frame. This last screw also retains in position the thin steel spring for controlling the end-shake of the musical barrel pivots when the left hand pivot shoulder of the musical barrel is against the brass strip screwed to the front movement plate.

The last hammer (No 10) should be approximately $\frac{1}{16}$ in. from the back rim of the musical barrel. This is clearly shown in Fig. 30. A change tune lever will be described later for pumping the musical barrel backwards for changing the tunes.

As in the case of the chime barrel it is better to defer pinning the musical barrel until the front and back plate mechanism has been made.

THE BELLS

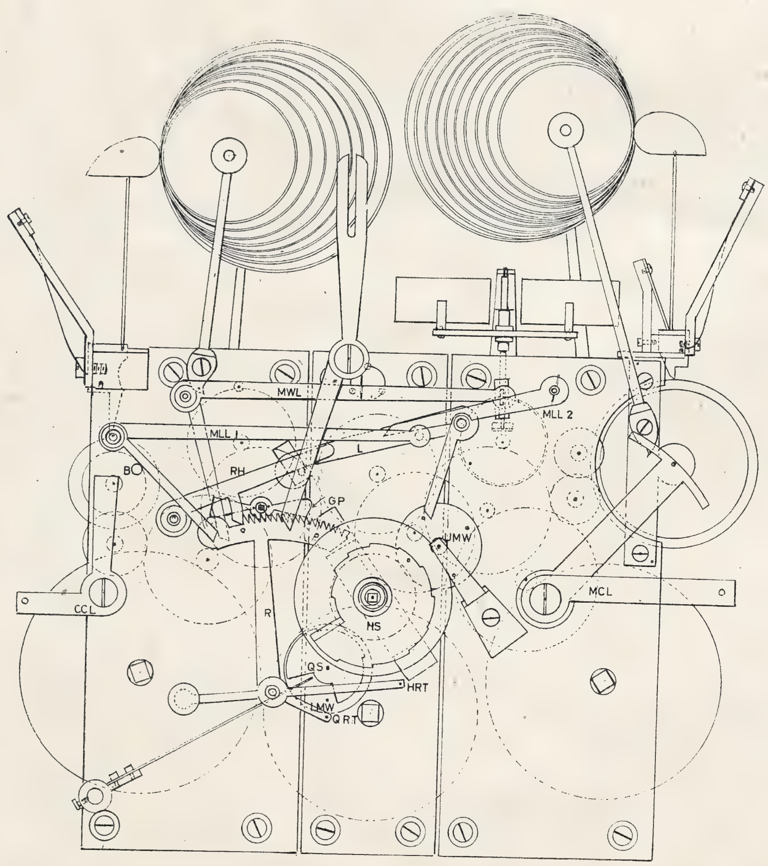
The two sets of bells can, however, be mounted. (The sets can be obtained from Messrs Mears and Stainbank, 114, Whitechapel Road, London, E.C.) The cost of a set of bells varies in relation to the size and number in the set. A small-size set of eight bells would be about £3. They are already tuned and only require mounting.

The usual method of mounting them is on a steel rod with wooden distance washers between each bell. The end of the rod is threaded, a nut fitted and then they are tightened up. But an objection to this plan is that the pressure of the distance washers kills quite an amount of their sounding power.

A method I have adopted is to tap a thread in the hole of each bell and screw them on a length of threaded studding. By this method the bells are supported quite loosely—as they should be to get the best possible results—and, moreover, they can be turned round to get the best position for the hammers to strike them. No working drawings are shown of the bell standards, but in the various drawings will be seen what is required.

Formerly steel forgings were obtainable for these items, but it required an enormous amount of labour to finish them well. The spoon-shaped piece is cut from $\frac{3}{16}$ in. thickness brass. A hole should then be drilled in the flat top-end of the spoon and the end of a suitable size piece of round brass rod is fitted to the hole, followed by silver soldering the two

Fig. 34: View of the front of movement



together. This makes a perfect joint with the minimum amount of finishing to do afterwards.

To the other end of the rod is fitted a disc of brass of the same thickness as the spoon. This is also silver soldered to the brass rod. A $\frac{3}{16}$ in. clearance hole is drilled through the disc and then two ring nuts are made and fitted for clamping the threaded rod to the bell standard.

It will be noted that the hammer heads are all in line with one another and the bells are arranged in a staggered position. This is better practice than mounting the bells square with the movement frame and bending the hammer stems for the hammer heads to reach the smaller diameter bells ; by adopting this method the chiming tends to be uneven when in action.

Before making the front and back plate letting-off mechanism the action should be carefully studied and thoroughly understood, as the functioning of the chiming, striking and musical playing are entirely dependent on these parts working properly.

Fig. 34 shows a complete view of the front-plate mechanism with the various levers returned to their normal resting position just after three o'clock has been chimed, struck and one tune played. The names of the various levers are referred to by letters and these letters are shown in the drawing.

It will be assumed that the minute hand is approaching the hour of three o'clock. One of the four lifting pins in the upper-minute wheel referred to as *UMW* will be approaching the lower arm of the lifter referred to as *L* and will gradually raise the lifter. Positioned at the left-hand end of the upper arm of the lifter is a pin which will raise the rack hook referred to as *RH*.

As the rack hook is gradually raised the point of the hook will be drawn away from the first tooth of the rack referred to as *R*. At the moment this happens the rack will fall and the pin in the long tail of the rack referred to as *HRT* will fall against the third highest step of the hour snail referred to as *HS* and at the same time as this happens the chiming warning wheel (centred near *MLL* 1) will rotate a short distance until the pin in its rim is arrested by the stop block fixed on the inside upper arm of the lifter.

This stop block goes through a slot cut in the left-hand movement plate. The lifting pin meanwhile on the upper-minute wheel will continue to raise—slightly—the stop block until finally the pin in the upper minute wheel will move past the extremity of the lower arm of the lifter, with the result that the rack hook will drop its point into the seventh tooth from the left-hand end of the rack.

A total of seven teeth are required for chiming and striking the hour of three o'clock; four for the four peals of the chime and three for the striking of the hour, when the rack falls. The quarter rack tail, referred to as *QRT*, will not reach what would be the fourth step on the quarter snail, as this has been cut away. The quarter snail is superimposed on the lower-minute wheel.

As soon as the rack hook has fallen into the seventh tooth of the rack the gathering pallet, referred to as *GP*, will rotate and gather up each of the seven teeth of the rack and, as the last tooth is gathered, one of the wings of the gathering pallet will be locked by the pin in the back of the rack.

THE CHANGE-OVER FROM CHIME TO STRIKE

Looking at Fig. 34 at the bottom left-hand front movement plate will be seen a long thin spring. This spring is clamped to the extremity of an arbor that passes through both movement plates, and shortly before the hour is chimed and struck a pin situated in the face of the lower-minute wheel impels the free end of this spring downwards, causing the arbor to rotate slightly clockwise.

Now at the bottom right-hand corner of Fig. 32a will be seen the other end of the arbor, to the extremity of which is clamped a two-arm lever, with a pin fixed on the upper end of each arm. The pin in the left-hand arm will have fallen into one of the five notches around the circumference of the brass disc situated at the left-hand end of the chime barrel arbor.

So long as the pin remains in its notch in the disc no rotation of the striking barrel can occur. Meanwhile the pin in the right-hand upper arm will be resting against the circumference of the disc attached to the end of the chime barrel. At the completion of the fourth peal of the chime the pin will enter the notch in the chime barrel disc and, at the same time, the pin will come out of the notch on the disc of the striking barrel, which will at once rotate—with the result that three o'clock will be struck on the large hour bell.

The two-arm lever will remain in its present position until about three minutes past the hour when the path of the pin in the lower minute wheel will be moved away from the extremity of the long spring, which will at once resume its normal position. This is due to the fact that situated at the bottom of the back movement plate is a weak counterspring which will return the two-arm lever to its previous position.

The pin in the left-hand arm will enter one of the five notches of the disc attached to the striking barrel and thus lock it. At the same time the pin in the upper end of the right arm will come out of the disc attached to the chime barrel and thus leave the chime barrel free for the next quarter. When about to chime the quarter past the hour, the highest step in the quarter snail on the lower-minute wheel will be in the correct position for the pin in the end of the shorter rack tail to fall against it—and thus the rack will only fall one tooth. The longer rack tail will not reach the hour snail situated on the hour socket tube.

The action at the half hour is the same except that the second step of the quarter snail is presented to the pin in the end of the short rack tail. At the third quarter the same action takes place, but in this case it is the third step of the quarter snail that is presented to the pin in the short rack tail.

It is only at the hour that the fourth step of the quarter snail is not used and, as previously stated, this segment of the snail is cut away so that the pin in the short rack tail cannot reach it, but does allow the pin in the long-rack tail to contact the steps of the hour snail when the rack falls.

THE MUSICAL RELEASE MECHANISM

The musical train is arrested by the long arm of the cam on the cam wheel locking against the stop block attached to the musical-locking lever referred to as *C* and *MLL* 4; on drawings this is shown in Fig. 32a. It is situated on the back movement plate and its pivot centre is seen near the chiming fly cock. The stop block is riveted to the lever near the left-hand end and goes through a slot cut out of the back movement plate.

Now going back to Fig. 34, there will be seen towards the top of the front movement plate a long two-arm lever which is the musical-locking lever, and referred to as *MLL* 1. There is a pin in the right-hand end of the long arm of the lever which will lift another arm of a shorter lever. The right end of this arm is cross-pinned to an arbor which goes through both movement plates. This lever is referred to as *MLL* 2.

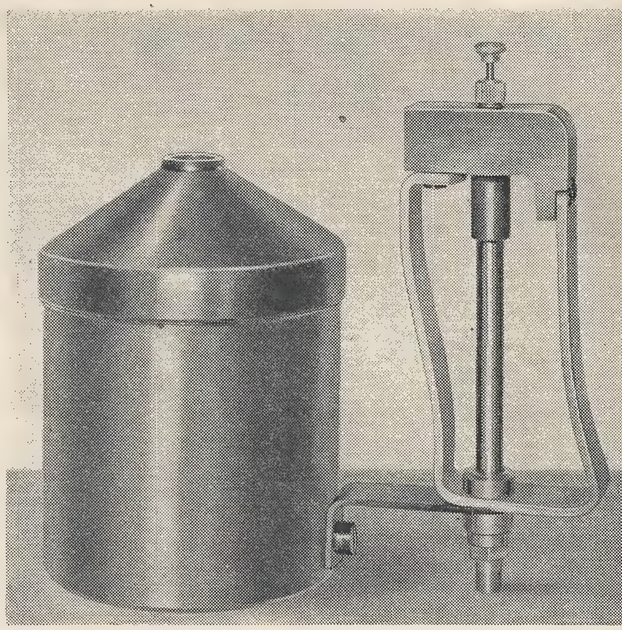
Situated on the extremity of the pivot to this arbor that passes through the back movement plate (Fig. 32a) will be seen another lever, referred to as *MLL* 3. The upper end of the lever is clamped to the pivot by a binding screw, but the lower end of the lever has a pin which will raise the cam-locking lever and release the musical train.

● *To be continued.*

Expert's Workshop

A paint SPRAY GUN

Concluding the three-part series by Duplex



THE control valve is built into the skeleton handle, *B*, and embodies the control-valve unit. This comprises the valve body, *B*1, the valve, *B*2, and the air pipe and union, *B*3, seen in Fig. 14.

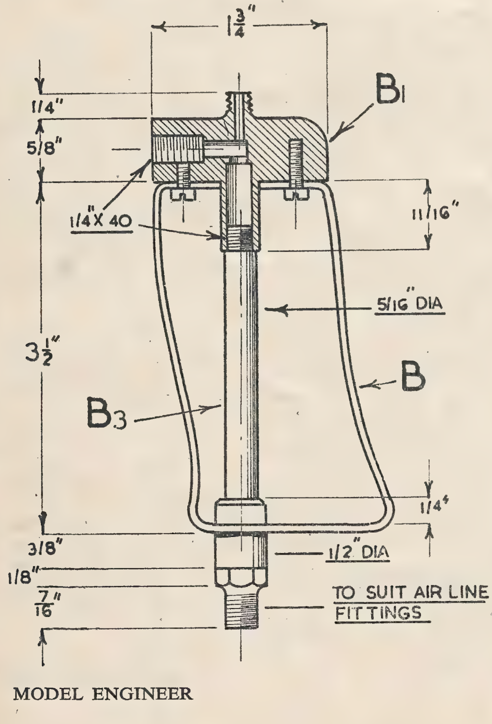
The skeleton handle is best made from light alloy or mild-steel strip bent up to the dimensions given in the detailed drawing Fig. 15. It will be seen that the shape of the valve body shown in this illustration varies from Fig. 14 and the dimensioned drawing Fig. 16. Constructors may choose which form they prefer, though the body illustrated in Fig. 14 is probably the easiest to machine.

As to the valve itself it will be seen that this consists of a plunger, a steel ball and spring to hold the ball against its seating. The plunger is, of course, operated by thumb pressure when the gun is held in the hand. To prevent the spring from slipping down the air pipe a small thimble (seen in Fig. 16) is set in the top of the pipe to serve as a platform or stop for the spring.

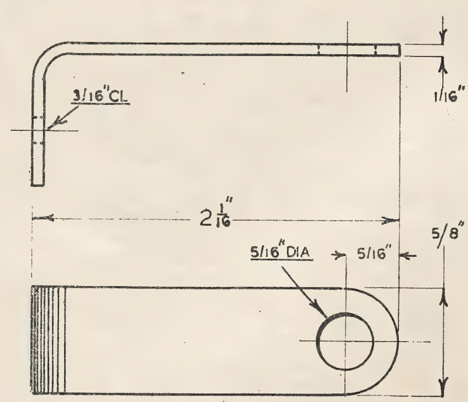
The air pipe must be relieved from strain when the gun is held in the hand; accordingly, a small rectangular stay is fitted to the container and secured under the union—by which means the gun itself is secured to the air line. This stay is depicted in Fig. 17.

As a result of practical working with the gun it has been found worth while to fit a small filter, made from brass wire gauze, to the lower end of the suction tube in the container. In this way any coarse foreign matter

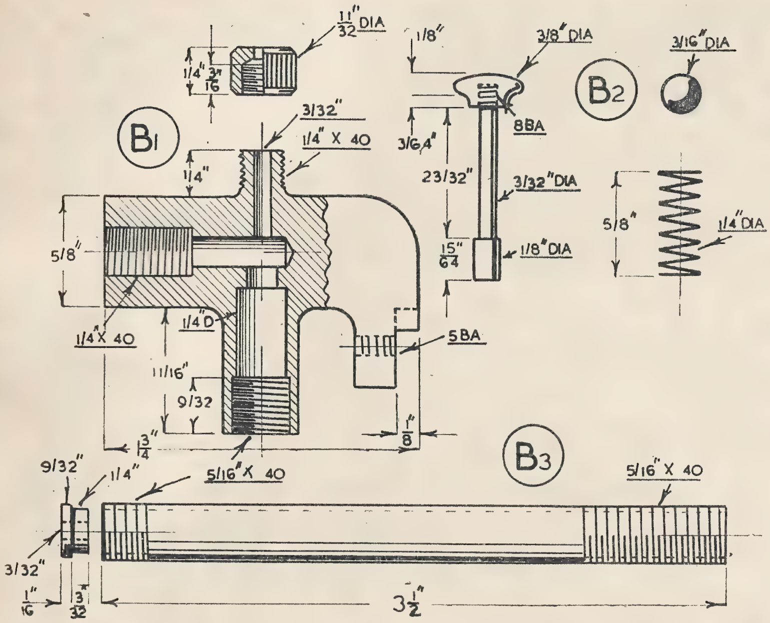
Above, Fig. 14: *Handle with control valve attached to the container*

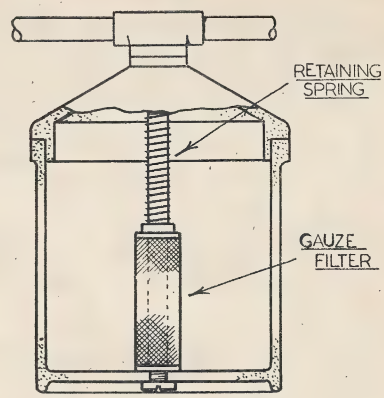


Left, Fig. 15: *Details of the skeleton handle*



Right, Fig. 17: *Stay for the handle*





Left, Fig. 16: *Details of the valve body, valve and air pipe*

Above, Fig. 18: *Gauze filter fitted to the suction pipe*

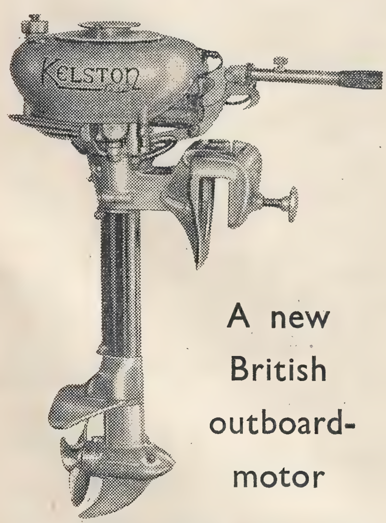
that may have entered the container will be filtered out before it can reach the nozzle of the gun. The arrangement of this additional fitment is illustrated in Fig. 18.

When using the gun it is essential that the air supply is adequate; the compressor providing the air should, therefore, be capable of supplying not less than 3 cu. ft per minute. For perfect atomisation of the material to be sprayed an air pressure of some 40-50 p.s.i. will be needed. If, in addition, the gun is to be used for cleaning purposes—such as the removal of oil and dirt from the engine of a car—then the air pressure should be of the order of 80-100 p.s.i. The higher pressure will enable the gun to dislodge dirt and grit from otherwise inaccessible corners of the engine.

If the gun is to be used for painting purposes it should be remembered that only thinly mixed paints should be employed, since the gun itself is not fitted to atomise or even lift the heavy-bodied pigments such as are needed for wrinkle finishes or for stove enamelling; a gravity feed gun is essential for such work.

In the past, when writing about spray painting, I have stressed the importance of keeping the paint gun clean. The present gun is no exception though, naturally, when using cleaning fluids or light-penetrating oils there is not the same necessity to clean out the equipment immediately after use.

Anyone who has had the misfortune to clean out a paint gun which has been left standing for any length of time will be only too well aware of the difficulties and the exasperation that the work causes. ■



A new British outboard-motor

EXTENSIVE testing on inland waterways followed by further prolonged and arduous tests at sea have been successfully carried out on a new British outboard-motor.

Named the Kelston Peto, it will be the lowest priced outboard of comparative specification in this country and, at £62, the makers—Kelston Engineering Company of Bristol—claim that it will cost considerably less than the American types so far seen in Britain.

The engine, of 100 c.c. capacity—it weighs 52 lb.—is a water-cooled single-cylinder two-stroke with a flat-topped piston. Lubrication is by petrol-oil mixture, introduced from the carburettor via a rotary valve in the crankshaft, and starting is by rope and safety-notch pulley. The connecting rod is of aluminium alloy with an unsplit single-eye big-end.

A new feature, a water-cooled crankcase, permits the expulsion of a much denser charge, capable of higher expansion, through the helical transfer ports. The water for cooling the engine is lifted by an impellor pump running at engine speed and allowed to exhaust at the full rate of the pump when the system is full. This method, with its fast flow through unobstructed passages, will cool the crankcase with maximum effect while allowing, through the restricted inlet to the cylinder, only sufficient to maintain a precise temperature.

Incorporated on the steering tiller is a twistgrip throttle control and constant throttle opening for slow trolling, etc., is readily obtained by adjusting the knurled handscrew which locks the twistgrip.

The $9\frac{1}{2}$ in. dia. three-blade propeller of aluminium alloy is driven by a shearpin in the propeller shaft. The shaft itself carries a cone-type clutch, which engages to obtain a drive from bevel gears to produce forward drive. (Neutral results when the cone is disengaged.) This mechanism, avoiding the use of dogs, serrations or ratchets, ensures a smooth take-up.

The propeller housing is protected from the water by well-proved oil seals, and the anti-cavitation plate, curved and partially enclosing the propeller, gives a nozzle effect that enhances efficiency. ■

READERS' QUERIES

Do not forget the query coupon on the last page of this issue

This free advice service is open to all readers. Queries must be on subjects within the scope of this journal. The replies published are extracts from fuller replies sent through the post: queries must not be sent with any other communications: valuations of models, or advice on selling, cannot be given: stamped addressed envelope and query coupon with each query. Mark envelope "Query," Model Engineer, 19-20, Noel Street, London, W.1.

Recorder capstan speed

I am experiencing difficulty with the capstan-drive speed ratios on a tape recorder I am building. The capstan comprises a very accurately lapped long sleeve bearing supporting a bronze flywheel carrying the capstan head, which is in two parts—one giving a speed of 3.75 in. per sec. and a sleeve to increase the diameter to give double speed, i.e. 7.5 in. per sec. The slower speed, giving twice the running time, is for speech and the faster speed, with its extended frequency range, is for music.

It is essential that the speeds be constant. A tolerance of $\pm$ 0.5 per cent. is to be aimed at, particularly if pre-recorded tapes, or tapes from another machine, are to be played. From my calculations (given a capstan diameter of 0.4 in. for a tape speed of 7.5 in. per sec.) the capstan is required to rotate at 538 rev. per min. I wish to know the diameters of the motor pulley and the flywheel pulley to give me the correct capstan speed.—L.W.J., Birmingham.

▲ *The first point to ascertain is the correct capstan speed for $3\frac{3}{4}$ and $7\frac{1}{2}$ r.p.m. respectively. Assuming no slip the length of tape passed by the driving capstan in one complete revolution will be* 3.1416 × *diameter of the driving spindle. If the latter is fixed at* 0.4 *in. dia. then* 1.25664 *in. of tape will pass per revolution. It is required to pass* 7.5 *in. per sec. so that the spindle will have to rotate at:*

$$\frac{7.5 \times 60}{1.25664} \textit{ r.p.m.} = 358 \textit{ r.p.m. approx.}$$

In the case of a tape speed of $3\frac{3}{4}$ in. per sec. this speed is naturally halved. This is taken care of by using, presumably, a detachable collar fitted to the driving spindle. As the motor used is not of the synchronous type, its speed is a factor of the load applied and the mains voltage. It is easier to reduce the diameter of the motor driving pulley than to increase it; thus assume the load is considerable and start with a motor speed of 1,074 *r.p.m. This gives a reduction of* 3 *to* 1, *the smaller pulley being as you correctly show, on the motor shaft.*

A lot of trouble has occurred from wow and flutter when using a rubber drive, and so an endless tape belt of cotton or plastic material, with a spring-tensioned idler roller, is recommended.

Measuring wind speeds

I am interested in some accurate method of measuring low and, of course, high wind speeds. I have already assembled an electrical device, but this was a failure as it was not nearly sensitive enough. I shall be obliged, therefore, if you will let me have a specification for a suitable pitot head and oblique tube spirit manometer—a general arrangement sketch if possible—and some guidance as to calibrating the apparatus in knots.—R.P., Sheffield.

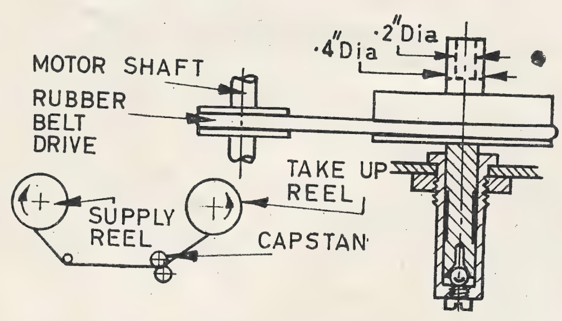
▲ *First of all the pitot head consists of two tubes, one known as the static tube and the other as the dynamic tube. The former is closed at the end and has air holes in the side for communication with the outside air, while the latter is open at the end so that it registers the impact of the air which it encounters. In modern types of pitot head the dynamic tube is usually enclosed within the static tube, but the same principles apply.*

The difference in pressure in these two tubes is registered by a sensitive manometer on the principle of the U tube, so designed that readings can be taken in one leg only, and this is inclined at a shallow angle to show the maximum difference in reading for a very small difference of pressure. If the difference becomes so great that the liquid is forced completely out of the sloping tube, it merely increases the height in the reservoir very slightly and returns to normal when the pressure is lifted—instead of being completely blown out of the manometer as in an ordinary U tube. Calibration, so far as can be ascertained, can only be done by comparison with a standard air speed indicator, but as the instrument gives a straight line reading intermediate points are easily plotted.

Hipp clock contacts

I am in the process of building a Hipp clock, with full-second length pendulum, and am experiencing considerable difficulty in fitting trouble-free contacts. The clock is running on three volts, with the coil taking 1/3 amp every 30 seconds or so. At the moment I am using platinum motorcycle points, and find that even these are fouling to the extent of causing the periodicity of contact to go up to once every 15 seconds, after a week's running.

I have experimented with various capacity condensers to remove the spark, and have discarded these in favour of a non-inductive buffer resistance of several thousand ohms, which has almost entirely prevented sparking but still not cleared up the problem. At the point of contact a brown spot develops and grows, necessitating frequent cleaning. Being a newcomer to the field of electricity, I have tried to get advice locally on what must be an elementary problem, but without success. On the suggestion of a friend, I arranged the con-



The arrangements of the tape-recorder mentioned in "Recorder capstan speed"

tacts so that they close with a slight wiping action; this helps for a while only.—J.H., Pietermaritzburg, South Africa.

▲ *Possibly one reason for the trouble is that the current consumption of the coil is heavier than should be necessary. Many clocks of this type having one-second pendulums of considerable weight are run with coils of about 30 ohms or more resistance, which would take less than 1/10 of an amp and this would obviously reduce the tendency to sparking. Platinum or platinum iridium contacts should be perfectly satisfactory and, in fact, there is no better contact material obtainable. But if you are using motorcycle contacts the area of contact may be too large so that the contact pressure in terms of p.s.i. is too low.*

In the synchronome type of clock the contact screw is only about 1 mm. in diameter, though the mating contact is larger in area to allow for displacement due to the wiping action. It is quite good practice to allow this wiping action to assist in keeping the contacts clean. You would not obtain any benefit from using carbon contacts and, generally speaking, neither condensers nor non-inductive resistance across the contacts should be necessary when working on such low voltages.

M.E. musical clock

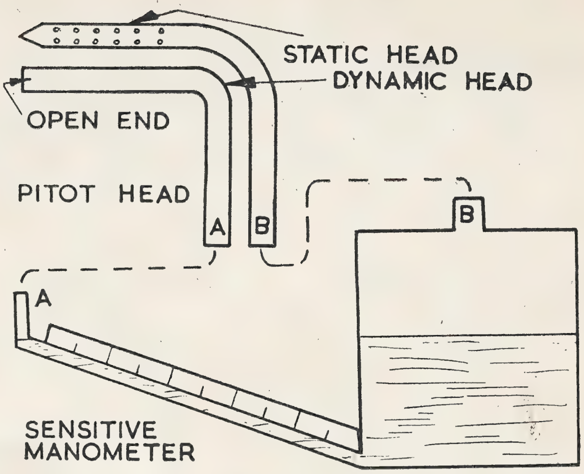
I am about to make the M.E. musical clock now being described by C. B. Reeve. For the plates I intend to use half-hard, *commercial* flat brass as supplied by S. Smith and Sons of Clerkenwell. Is this suitable and flat enough? Secondly a friend advises me to bush each hole. Is this desirable or necessary?—L.G.M., Sandwich, Kent.

▲ *Commercial half-hard brass sheet would be suitable for the plates of this clock, but as suggested by the designer it may be necessary to carry out some work in planishing the material to exact flatness, as it is very difficult to ensure that it is perfectly flat on purchase.*

With reference to bushing the pivot holes it is an advantage to fit bushes of a good-quality bearing metal. But it is not generally regarded as necessary in the majority of cases, as the wear is extremely small and many clocks with unbushed plates have lasted for well over one hundred years without excessive wear taking place.

Compressor adaptation

I have a refrigerator type compressor and I wish to use it as an air compressor. It has two pistons, a $10\frac{1}{2}$ in. driving wheel and a maximum output of $2\frac{1}{2}$ cu. ft min. at 180 p.s.i. Driven at 700 r.p.m. what h.p. motor would it require for maximum output and, secondly, should the motor revolve at 1,420 or 2,850 r.p.m.?—F.W.H., Hanwell, W.7.



Set-up for measuring wind speeds accurately

▲ *This machine driven at 700 r.p.m. and delivering $2\frac{1}{2}$ cu. ft per min. at 180 lb. per sq. in. will require approximately $1\frac{1}{2}$ h.p. to drive it at full output. The most convenient motor speed would be 1,420 r.p.m. as this would enable a belt reduction drive of approximately 2 to 1 to be used, which would be more efficient than using a higher motor speed with a greater ratio of reduction in the belt drive.*

Induction motor trouble

My squirrel cage rotor heats up to such an extent that it throws solder from the end rings. Are the copper bars of the rotor insulated from the laminations? If so, what insulation is used and what tests can be applied to the rotor to ascertain whether it is in correct working condition?—B.L.T., Auckland, New Zealand.

▲ *An overheated squirrel cage rotor can be due to overload, a faulty bearing or bearings, faulty joints in the bars and faulty core plates. Where this trouble is due to overload the trouble will be in the soldering of the rotor bars; faulty bearings can alter the air gap of the motor and so cause heavy currents to flow in the rotor. In the older types of motors the core plates were usually insulated by the use of tissue paper between plates. In time this insulation becomes defective and gives rise to heating of the rotor but there are no tests to show the state of such a rotor. The bars through the core need not be insulated. In modern practice these bars are usually cast in together with the end rings, using a suitable alloy. If the heating has suddenly shown itself it is obviously overload; the collapse of a rotor of this class comes on gradually with time.*

A motor with a defective rotor is sometimes difficult to start and in running may be below speed and give a varying speed on load. What you should do is to melt the solder completely from the rotor and remove the bars. Thoroughly clean and re-tin the bars and the end ring and its holes or slots. Then reassemble the bars and rings and resolder them in place again. A blowlamp is suitable for this job. Now assemble the motor and run up and put on the load in the usual way. If you find the motor does not start very well or does not take its load, the resistance of the end rings is too low. To rectify this some of the solder on the end rings must be removed until conditions are normal. Note that a high resistance rotor of this class will also be weak in starting and also account for excessive heating.

Sherardizing

Can you give me any information regarding sherardizing small nuts and bolts? Has there been an article on the subject in MODEL ENGINEER?—W.G., Liverpool.

▲ *Component sherardizing is a commercial process, but there is no record available of anyone who has carried it out successfully in an amateur workshop. There are, however, several methods of producing a protective coating on small parts, one of the simplest being to boil the parts in water containing about a 10 per cent. solution of cream of tartar with a small amount of pure tin in a granular form. This produces a dull coating of tin which can be polished if desired, but if a similar finish to sherardizing is required this is unnecessary.*

POSTBAG

The Editor welcomes letters for these columns, but they must be brief. Photographs are invited which illustrate points of interest raised by the writer

CLOCK SPRINGS

SIR,—W. R. Field is having difficulty in purchasing material for clock suspension springs.

May I suggest Moore and Wright's feeler gauge blades in the 12 in. × ½ in. size. These are 29 standard thicknesses from 0.0015 in. to 0.025 in. Metric sizes can be supplied to order. Buck and Ryan can supply most sizes over the counter. Prices vary from about 1s. 6d. to 2s. 6d. a blade.

I find it extremely difficult to drill, so holes should be pierced as mentioned by Mr Reeve in a recent article.

It is refreshing news to hear of such firms in the clock industry as Osborne's and Frank Pike. Many concerns seem to shroud their trade with mystery and assume that all model engineers are bodgers or money grabbers anxious to steal the clock repairer trade.

New Barnet, Herts. H. E. MILLER.

SIR,—Some readers interested in making C. B. Reeve's clock seem to be having some difficulty in obtaining ½ × 0.008 suspension spring. This size spring as well as a 0.004 can be obtained from Blakiston and Co., 73, Brougham Street, Skipton, Yorkshire.

The prices are: 0.004 1s. per ft and 0.008 2s.

Eastbourne. B. F. ROBINSON.

SIR,—Referring to Vulcan's note [Smoke Rings, December 20], Messrs Buck and Hickman can supply spring steel feeler strip ½ in. wide in 12 in. lengths and thicknesses of 0.0015 and 0.002 by thous to 0.025. The price is about 1s. 6d. per length.

I have used this material in 0.006 thickness for the 1 sec. Hipp pendulum for the clock described in *Electric Clocks*.

INTERESTED.

PEARL BEYOND PRICE

SIR,—It may be that the $\frac{3}{16}$ in. silver-steel pins are dowel pins which are used to locate the saddle to the apron ["Anyone Know?" Postbag, December 20]. On my lathe I think that is the only place where such pins are used. There are two or three bolts under the saddle somewhere near the topslide nut and when these are removed and the leadscrew is withdrawn the apron will then drop clear of the saddle.

With regard to the leadscrew, there is no means of locking this and when the saddle is traversed from the handwheel the fixing of the leadscrew depends upon the resistance of the cluster of screw cutting gears and their gearing to the tumbler reverse.

It will be found that when the change wheels are set up for a fine thread or a normal fine feed the resistance is quite sufficient to enable the saddle to be traversed without any movement of the leadscrew.

Another way of traversing the saddle is by disconnecting the change wheels and using a handwheel fixed on the tailstock end of the leadscrew.

Mr Adamson must count himself fortunate in obtaining a Milnes lathe in mint condition. He no doubt gained a pearl beyond price. My lathe is a type earlier than his, built somewhere about 1926. I have had it since 1929 and have done an immense amount of work on it. Even in its present condition I am able to produce fairly accurate work. The headstock bearings have not been touched since it was new and but for a certain amount of normal wear on the bed it is still a very good lathe.

Kingston, Surrey. G. C. SMITH.

SIR,—With regard to Mr Adamson's request for information I may say that I have had a Milne's lathe for over 30 years and it is in good order and accurate today.

Here is the maker's description of the apron: "Apron (patented) gives quick and easy motion when traversing saddle by hand. Projections round leading screw nut ensure quick engagement for sliding. Whilst by using only one [this 'one' projects further than the others] for screwcutting this operation is greatly simplified. When *plunger* is out of engagement the nut revolves with the leading screw and also provides automatic lock for saddle."

If Mr Adamson has not lost the plunger the only thing that can be hindering the saddle from working properly is the fact that if no train (compound) is set up in the quadrant the leading screw *revolves* and the saddle remains stationary.

Kirkcudbrightshire. W. G. INNES.

WIDER RANGE

SIR,—On reading MODEL ENGINEER from cover to cover each week, I can't help noticing the number of times that steam is mentioned in some form or another.

I think, without causing an upheaval, that some of this valuable space could be used to print articles on a far wider range of models that could be constructed in a home workshop.

This brings up the subject of equipment. The form of equipment I would like to see described in MODEL ENGINEER is on self-contained machines such as motorised lathe, milling, shaping, planing, honing, grinding, drilling, sawing machines and a hydraulic press.

I hope my wants are not too great and that there are other readers who would like to see articles on this equipment and on a wider range of models.

New Zealand. SAFETY VALVE.

NOSTALGICALLY SPEAKING

SIR,—With reference to an article on sleeve valves by L.B.S.C. [MODEL ENGINEER, October 4], when I first read this I dashed off six foolscap pages, then I decided to wait and contact some old members of the Omnibus Society, and a few friends who were at the old L.B. and S.C.R. works before me.

If the drawing is of the junk-head of a Knight engine it is not correct (no junk rings). The statement that the original Daimler bus was not a success owing to engine trouble is not correct (Omnibus Society's records); the wire-wheels were at fault.

The twin-motor drive was used for years on the Halford-Stevens. Many ran on Brighton's hills, and the Daimler-Knight buses were the most successful that ran here in early times.

The chain-drive gearbox he mentions was the Sheffield-Simplex which was used on many heavy vehicles.

Why does L.B.S.C. not tell us about the Knight-engined railcar which ran between Brighton Central and Kemp Town? Many times it carried me to school, usually pushed by the 0-4-2 tank *Boxall* (smaller than

the Terrier class ?) because the plugs wanted cleaning and no one had a $\frac{5}{16}$ in. tube spanner; or the balls in the Daimler carburetter had got stuck.

Later, when I joined the old locomotive works, I saw the truck of this car being used as a welding bench. This was the period of the building of the Rememberance class tanks, of which *Stevenson* was the first.

I visited the works on August 8 last, with some friends from some of the larger and more modern engineering works in the town. It was sad to see the old No 333, on which I had done so much turning work, being cut up for scrap, but I was considerably cheered by some of the comic remarks of my friends, particularly on the age of some of the alleged machine-tools.

There is an old gentleman living near to me who used to drive one of the National steam buses (Clapham Rink run). I rode on these beautiful vehicles many times. They had red leather upholstery, silver-plated handrails and electric lighting from a separate engine in the driver's cab.

I have a cardboard working model of the Knight engine, made to show how the ports open. It was given to me at a lecture at the Old Ship Hotel, Brighton, 1904.

The Sandy Lane Works of Daimlers may have been built by 1904; all I know is that it was still being built when I was with Standards (Foleshill Road Works) in 1916.

Brighton 7. G. GOLDRING.

LOOKING BACK

SIR,—Regarding "Names Please" [Postbag, November 22], I think the taller of the two men is a Scotsman named McFarlane or McFerson. The shorter is a North Country man.

The regular driver of S272 was Bob Stephenson from Bolton. I steered for him for a while until I was given S271.

The Commer wagon was one of a fleet of Commers belonging to the 40th Aux. S. and P. Coy. If Mr Nichol was one of us perhaps he will recognise some of the boys. Does he remember Amos Roe, Sam Florry, Hamilton Finley, Billy Dobbin, Slash Allen and Yorky ?

I wonder how many of those chaps read MODEL ENGINEER. If any do I would be glad to hear from them.

Barnoldswick. JOHN T. BRYDEN.

VARIATIONS IN APPLIANCES

SIR,—The letter from E. C. Wright regarding the "vibrations" felt with certain apparatus is partially correct. The vibrations felt are due not to "the vibrations of the alternating current mains" as such but more correctly to the varying magnetic fields set up by the current flowing through the apparatus.

In an electric iron the element which is wound in the form of a spiral becomes magnetised with an alternating field and this causes the vibratory feeling. With radio receivers the mains transformer is responsible for the vibrations; this is easily proved if a screwdriver is held lightly against the frame of the transformer. The more current the apparatus consumes the stronger the varying field set up.

An earth connected to the appliance will not remove this field but will remove any leakage current which may cause a similar feeling at the finger tips. The reason why the vibrations disappear when the appliance is gripped tightly is simply that the finger tips respond better to a light touch and a firm grip removes this sensitivity.

E. C. Wright does not state how he measures his insulation resistance of 20 megohms. If an ohmmeter was used the reading is useless for mains-operated appliances. I always insist on a final test with a 500 v. megger.

It is not generally realised that the mains voltage, where a.c. is concerned, is always quoted in r.m.s. values and that the peak voltage is about 1.4 times the r.m.s. For example, an a.c. mains supply may be given as 230 v., the peak voltage in this case is in the region of 320.

The blue glow observed when breaking the old valves is probably due to the presence of ionised gas in the glass bulb exploding due to the heat generated by the breaking glass.

Swansea. H. C. HEMMENS.

GENERATING ELECTRICITY

SIR,—With regard to the recent comments on Calder Hall, it does not appear to be generally appreciated that the main duty of the station is to produce plutonium, and that the generation of electricity is only a

Recognise anyone ? Somewhere in France in the 1914/18 *war. See "Looking back"*

POSTBAG . . .

useful way of utilising the heat released in the reactors during the operation.

The steam conditions at the turbine stop valves are:

H.P. steam, 200 p.s.i. absolute.
H.P. steam temp., 590 deg. F. = 208 deg. F. of superheat.
H.P. steam flow, 198,000 lb./hr.
L.P. steam, 53 p.s.i. absolute.
L.P. steam temp., 340 deg. F. = 150 deg. F. of superheat.
L.P. steam flow, 59,300 lb./hr.

The pressure at the turbine exhaust flange = 1.75 in. Hg. Maximum continuous rating of the alternator is 23 mw. No feed heaters are used and all steam passes to the condenser.

This is undoubtedly a retrograde step in steam condition compared to a modern coal or oil fired power station but the reason is that at present only certain of the metals are suitable for the fuel containers from the view of nuclear fission, and these are of a relatively low melting point.

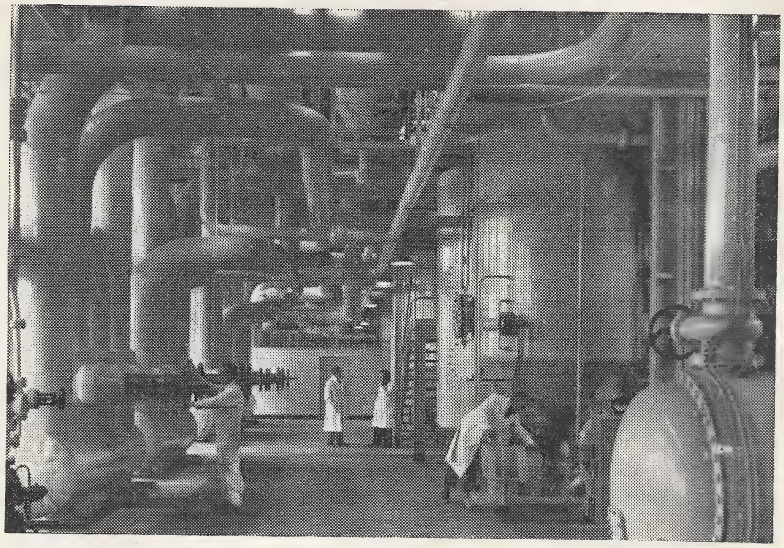
Considerable metallurgical research is going on and it is certain that this difficulty will be overcome.

Again, although other and higher temperature reactor circuits are known, the designers very wisely decided that the reactor must be inherently safe. Of these, the graphite-modulated gas-cooled reactor is the safest. Equally, the steam side designers also showed great brilliance.

When a steam turbine is at full load, about 55 per cent. of the total work is done in the l.p. turbine. This feature was the basis used in the design of the Calder Hall turbines, these being designed for a steam pressure which could be generated by the hot gases from the reactor and the heat exchangers or boilers are, in effect, coolers for the reactor gas circuit, and to ensure maximum cooling capacity for the reactor gas improvements to turbine thermal efficiency, such as bled steam feed heating, was sacrificed.

I agree with Vulcan that the term reactor furnace is wrong, but I would like to point out that British and American technical treatises on the subject both talk of reactor-fired boilers, and I suggest that this is due to difficulty in finding a suitable simple term to describe the heat released in a reactor on load.

It is not always appreciated that in any land water-tube boiler at least 40 per cent. of the total heating surface available for steam generation is heated by convection of the hot gases, and that even in the radiant heat part of the boiler every effort is made to prevent the flame from touching the tubes, while in the Calder Hall boilers *all* steam generating and superheating is by convection.



The steam generating section of Calder Hall power station

Incidentally, in modern steam boiler practice in power station work it is more usual to refer to the furnace by the more correct term of combustion chamber.

As to whether electrical energy will ultimately be generated direct from some form of atomic energy, I think it may, but at present all the experts are emphatic that for a very long time to come nuclear energy can only be used by our old friend steam.

With regard to reactor-fired power stations for the electric supply industry I do not think that the Calder Hall design, brilliant as it is, is truly indicative of what will be used in them.

In August 1956 an order was placed in America for a 236 mw. turbo alternator and reactor fired steam generating plant. The steam conditions are to be 335 p.s.i., 1,000 deg. F., the high steam temperature being obtained by a separately pulverised fuel fired superheater. It is interesting to note that by doing this, the capacity of the unit is increased from 140 mw. to 236 mw. with a considerable decrease in operating costs.

With regard to coal-fired power stations, the latest operate at steam conditions of 1,500 p.s.i., 1,050 deg. F. on 60 or 100 mw. machines (the smallest size now considered for electric generation). They are usually designed to exhaust at 1.3 in. Hg and about 30 per cent. of the steam passing through the turbine is bled off for feed water heating, etc., which means a great saving in latent heat. The Units Sent Out thermal efficiency is 32 per cent.

Early this year the first 120 mw. machine will be in commission, with steam conditions of 1,500 p.s.i., 1,010 deg. F. reheating to 1,000 deg. F. Turbine exhaust pressure will be about 1.3 in. Hg and about 35 per cent. of the steam will be bled off. Sent Out efficiency will be about 35 per cent.

These will be followed in 1959 with 200 mw. machines with steam conditions of 2,450 p.s.i., 1,060 deg. F. reheating to 1,005 deg. F., with a turbine exhaust pressure of 1.1 in. Hg and about 40 per cent. steam bleed. Sent Out efficiency will be 40 per cent.

I don't think it is appreciated what this means, or the tremendous advance in operating conditions made by the boiler and turbine manufacturers of recent years, who were at times working without previous experience to help them.

Strange as it seems pressure in itself is no difficulty, but temperature is a totally different story. Here a rise of 50 deg. F. can have considerable effect, while a pipe or piece of machinery operating at 1,050 deg. F. is glowing red.

Finally, the chairman of a firm of major locomotive builders recently quoted the following overall thermal efficiencies for various types of motive power.

Steam locomotive, 7 per cent.
Gas turbine locomotive, 14 per cent.
Electric locomotive, 17 per cent.
Diesel locomotive, 26 per cent.

As one who loves the steam locomotive, irrespective of its "guts hanging outside," I must admit there is no doubt that electrification of the railways is necessary from both economic and air pollution standards.

Maidenhead, Berks. G. D. WEBSTER.

★ ★ ★ CLUB NEWS ★ ★ ★

Edited by THE CLUBMAN

BY making up the simple necessary tools, the modeller may enjoy the fascination of producing strong lightweight model parts from sheet metal and tube.

How this is done through the exercise of a little-used craft was described to members of Rochdale S.M.E. by Mr Thomas Brooks in a talk on metal spinning for the model engineer. After dealing with the methods used in industry to make components by orthodox spinning methods Mr Brooks compared the types of lathe and tools usually found in the modeller's workshop with the larger machinery used professionally, and assured his audience that small spinnings such as the model engineer would need could be produced with the limited power available.

A collapsible former

As the best possible proof Mr Brooks submitted several examples of spinnings in copper and aluminium, together with the formers, tools and other equipment employed in making them. One of the examples, a miniature propeller spinner, required a collapsible former to produce. Another exhibit was a pair of silencers spun from a 1¼ in. dia. copper tube for a 30 c.c. Atom V engine.

Explaining that the silencer was one of the compound parts needed by speedboat men, Mr Brooks added that it seemed to offer no alternative method of construction. The pair did much to enhance the appearance of the engine.

Mr Brooks was thanked by E. Hutchinson, the chairman, for an interesting talk on a subject fresh to many.

AND THE PARTS WERE LARGE!

Members of Eltham and District L.S. have studied with great interest the 5 in. gauge Schools locomotive being constructed by Mr J. Ewens.

The modeller, who is a physicist, brought along the parts when he gave a talk at the Beehive. The parts were, of course, large and the members helped to move them into the club room. Secretary F. H. Bradford (19, South Park Crescent, S.E.6), one of my most conscientious correspondents, tells me that the boiler is quite enough to carry for any distance.

For the members, who had already seen the partly-finished chassis at an earlier meeting, the occasion was of particular importance and interest. They discovered that the model was progressing rapidly, and they are now awaiting with renewed eagerness the day when it will be ready for portable track operation.

Eltham did not have its "Any Questions?" night after all. Other business compelled the programme to be deferred until the new year.

In April the society celebrates its thirteenth birthday with the same officers on the executive as in 1944. May 1957 be a lucky 13 for all of them, and for all the other members of this alert and progressive club.

THEIR PRIVATE SHOW

I am surprised that there was only one entry in the locomotive section of the private exhibition held by Harrow and Wembley S.M.E. Models in general were fewer than in the previous year, but the photographic section had 40 prints and the attendance was pleasing.

The Loco Cup went to Frank Tucker's 3½ in. gauge Schools Class engine. This, the single entry, won a silver medal at the M.E. Exhibition.

M. Simpson won the Marine Trophy with a neat radio-controlled tug whose well-built hull was made of shaped aluminium plates secured by adhesive. The transmitter and receiver were also the work of the builder. Reg Uphill, last year's winner, was runner-up with a steam plant.

Once again treasurer Sid Walter won the General Section Cup. His successful entry, outstanding in a particularly varied field, was another M.E. medal winner—a 25-pounder gun.

As usual, the judging was by the vote of the members. In the handicraft section they cast an equal number of votes for Jim Hobson's excellently finished silver spoons and Jimmy Lawrance's attractive bowl in beaten copper.

Decisions also proved difficult in the photographic section. Here the poll was headed appropriately by Peter Reed, the section leader, followed by M. Simpson. The work entered gave obvious evidence of progress.

Stuart Harvey gained the Junior Handicraft Cup with some beautifully wrought engineer's tools.

INSURANCE DISCUSSED

New proposals concerning insurance, with a possible increase in subscriptions, were on the agenda when Malden and District Society held its annual meeting, after a busy and successful year, at the Clubhouse in Thames Ditton.

Malden has two vice-presidents, both well known to readers of MODEL ENGINEER: J. N. Maskelyne and Edgar T. Westbury. The president is H. Macey, the treasurer W. G. Webb and the secretary G. C. Smith (101, Tudor Drive, Kingston-on-Thames).

Social secretary W. J. Thompson left in November on a jaunt to Pakistan.

WEST COUNTRY LINKS

As a happy beginning to the new year, Bath and District S.M.E.E. is inviting its good friends of Bristol and Trowbridge to a film show at Bath Technical College, Lower Borough Walls, on January 21. "This effort," writes secretary F. S. Wilton (The Cottage, South Stoke, Bath), "is being made to form a link with our neighbours on each side of us."

Announcing that Mr F. H. Culverhouse of British Railways will be in charge, Mr Wilton adds: "We expect to have a jolly evening."

M.E. DIARY

January 17.—Hull S.M.E. film show.

January 18.—Birmingham Ship Model Society "Reminiscences," H. R. G. Whates. J.I.E., Pepys House, "History of Diving," C. E. T. Warren, 7 p.m.

January 19.—M.P.B.A. annual meeting, Central Club, 127, Clerkenwell Road, E.C.1, 2.30 p.m.

January 21.—Bath S.M.E.E. film show with Bristol and Trowbridge guests, Bath Technical College.

January 25.—Merseyside branch, World Ship Society. "St Lawrence Seaway," George Musk (C.P.R. historian), 7.30 p.m. J.I.E., Pepys House. "Fire Fighting Equipment," Edmund S. Calvert, 7 p.m. Welling and District M. and E.E.S. "Materials for Locos."

Model Engineer

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WORKSHOP EQUIPMENT

Buck & Ryan for Lathes and Workshop Accessories, drilling machines, grinders, electric tools, surface plates, etc.—310-312, Euston Road, London, N.W.1. Phone: Euston 4661.

Immediate Delivery from Stock, Myford "ML7" and "Super 7" lathes, Super Adept lathes, bench planers, shapers, electric motors, small tools.—F. W. KUBACH, 12, Sylvan Road, London, S.E.19. LIV 3311/12.

Lathe Attachment and castings, drill grinding jigs. List 6d.—G. P. POTTS, Yew Grove, Troutbeck, Windermere.

Users of the "Atlas," "Sphere," "Halifax," "Acorntools," and "Little John," 5″ s.s. and s.c. lathes will be pleased to know that all spare parts and a comprehensive range of additional equipment are available ex-stock—send for price lists. Spare parts also available for the "Atlas" and "Buffalo" (U.S.A.) drilling machines. —THE ACORN MACHINE TOOL CO. (1936) LTD., 610-614, Chiswick High Road, London, W.4. 'Phone: Chiswick 3416 (5 lines).

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Vernier Calipers for Inside and Outside Measurements (including case). Readings metric or English, or both. Sizes, 6″-48″ at prices unparalleled: example 20″ gauge, £16. Price of other sizes on request. —Below.

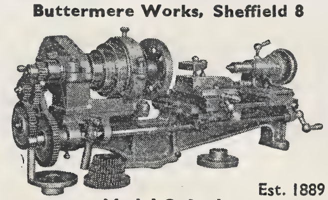
Vernier Height Gauges (including case). Readings in metric or English or both. Sizes 10″-30″. Price example: 12″, £16 10s. Price of other sizes on request. Supplied by—ULTRATEK LTD., Victoria Works, Bingley, Yorks.

Wanted. ML7, Super 7, Boxford, or similar. Privately, cash. Can collect London area.—2, Isabella Road, Homerton, London, E.9.

Wanted. Secondhand Myford ML7, accessories, condition, price, etc., to—G. V. REID, 18, Elms Avenue, Eastbourne. Light precision turning undertaken at reasonable terms.

Ideal Lathe, 3⅜″ B.G.S.C., motorised on stand, chucks, accessories, £25.—131, Springdale Road, Broadstone, Dorset.

CHARLES PORTASS & SON
Buttermere Works, Sheffield 8



Model S. Lathe Est. 1889

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Fretsaw and Disc Sander, driven by ¼ h.p. motors complete on stands, not toys. Quantity of plywood, suitable toymaking, £27.—CARR, 122, Worth Road, Pound Hill, Crawley.

For Sale. New and unused at 50 per cent. maker's price, H.S.S., M.T.S. drills and reamers, $\frac{3}{16}$″ to 1½″.—THE DENE TRADING Co., 35, Queens Road, Newcastle-on-Tyne 2.

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4½″ Winfield Lathe B.G.S.C., 1/3 h.p. motor, s.c. independent and drill chucks, £35. —RODNIGHT, Bourne Hotel, New South Prom, Blackpool.

4 Jaw 8″ Crown independent chuck, as new, £5 o.n.o. or exchange for 5″ ditto.—R. W. PARTIS, 5, Bellfield Avenue, Brightlingsea, Essex.

Lathe 3½ B.G.S.C. 3-jaw, 4-jaw, steady, back toolpost, stand, motorised, £25. 4″ Relmac, cast-iron stand, countershaft, new mandrel, ML7 nose, no chucks or motor, £12.—HARPER, 4, Square Close, Turville, Henley-on-Thames.

Complete Workshop. Lathe, milling machine, grinder, bench drill, motor, belt driving complete in iron frame. Many accessories, and material. Bargain.—White-Hart, Colyton, Devon. Phone 439.

Sale or Exchange two Boxford 4½″ × 22″ Model "C" lathes both new and unused, £180 the two or exchange both for Boxford Model "A" or small geared head lathe, Baty dial gauge reading in tenths of thous unused cost £6, sell £3. Starrett dial gauge as new, 45s. Other items s.a.e.—8, Spital Lane, Sheffield, 3.

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Pittler Lathe, 3½″ × 15″, motor and treadle overhead gear, complete screw cutting, equipment, compound rests. Full range of collets, dividing head, cutter frame, four slides, fixed and travelling steady. Full manual, £50 o.n.o., Sheffield.—Box No. 8381, MODEL ENGINFER Offices.

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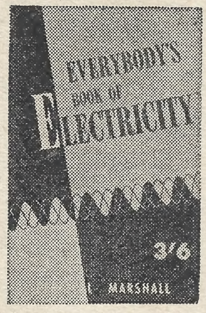

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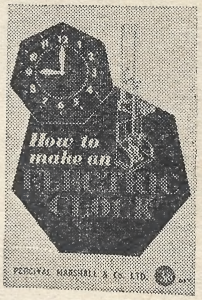

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Registered for transmission by Magazine Post to Canada including Newfoundland.

M.E. QUERY COUPON JANUARY 1957